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THE FUNCTION OF THE STATE UNIVERSITY.[1]

THE UNIVERSITY OF ILLINOIS owes its foundation to the initiative of the federal government of the United States.

The celebrated Morrill Land Grant Act of July 2, 1862, provided that each state in the union should be granted thirty thousand acres of land for each senator and representative to which the state was entitled in the federal congress, for the establishment and support 'of at least one college, whose leading object shall be (without excluding other scientific and classical studies, and including military tactics) to teach such branches of learning as are related to agriculture and the mechanic arts, * * * in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life.'

This has turned out to be one of the most magnificent endowments of higher education ever made by any government, church or individual, whether we have regard to its immediate effects in leading to the establishment of the particular institutions contemplated in the act, or to its remoter effects in further increasing and stimulating state benevolence for this same general purpose.

As the result of the said grant, at least one institution corresponding to the above description has been established in each state and territory in the union. There

[1] Inaugural address of Dr. Edmund Janes James on the occasion of his installation as president of the University of Illinois, October 18, 1905.

are now more than forty-nine in all! The states have in nearly every instance contributed to the further endowment of these colleges in the form of permanent funds or what is practically the same thing, in the form of permanent annual appropriations, exceeding, and in some cases far exceeding, the amount given by the federal government itself.

In some instances the new college was incorporated in, or annexed to, some existing institution. In others it was made an entirely independent institution limited to instruction in agriculture and the mechanic arts. In still others it became the nucleus of a great state university, with all the departments properly belonging to an institution which may justly lay claim to that time-honored name.

This was the case in Illinois. The proceeds of the sale of this original land grant constitute an endowment fund providing about thirty-two thousand dollars a year for the support of the institution.

In 1887 the federal government passed an act known as the Hatch Act, providing an appropriation of fifteen thousand dollars a year, to each state in the union, for the establishment and support of an agricultural experiment station. This, in the state of Illinois, was made a department of the state university.

In 1890, by what is known as the second Morrill Act, the federal government appropriated an additional sum of fifteen thousand dollars a year, to be increased by one thousand dollars annually until it reached the sum of twenty-five thousand dollars a year, for the further endowment of colleges of agriculture and mechanic arts, founded on the act of 1862. This sum, in Illinois, was naturally also turned over to the state university, so that, by these various federal acts, the University of Illinois now receives, either directly or indirectly from the federal government, about seventy-three thousand dollars a year, to be applied in the maintenance of an agricultural experiment station, and the colleges of agriculture and mechanic arts.

The state of Illinois has added largely to this sum of seventy-three thousand dollars for the support of these two enterprises. The last legislature, for example, appropriated four hundred thousand dollars per annum for the support of these departments, or more than five times as much as the federal government. In addition it also appropriated considerable sums for the support of other departments which, although not mentioned specifically in the Land Grant Act of 1862, were contemplated by the words 'not excluding other scientific and classical subjects.'

In other words, the state of Illinois has not only applied conscientiously to the purposes of the federal act all the funds which the congress has provided, but it has actually appropriated five times as much for these same purposes as the federal government itself. In addition it has provided for the other departments necessary to transform the original college of agriculture and the mechanic arts into a full-fledged university of the modern type.

The comparatively small sum thus appropriated by the federal government has led in the sequel to the expenditure of ten times as much for higher education by the state of Illinois. The other states have followed in the same general path, so that it is doubtful whether a similar expenditure of funds to that made by the federal government on this occasion ever led to proportionately greater returns for higher education, in the history of any time or country.

The University of Illinois has become the largest of the institutions which owe their origin to this federal grant. Opened for

work on March 2, 1868, with fewer than one hundred students, its growth for the first twenty years was very slow, as the state at first declined to give very largely in addition to the federal grant. Indeed, it seemed inclined for a time to limit the institution strictly to the work of a college for agriculture and mechanic arts, in the narrowest sense, as was indicated by the name first selected for it, namely, 'Illinois Industrial University,' and by the refusal of the legislature to do more than apply in good faith the proceeds of the federal grant to its support.

But about the year 1887 a new spirit became manifest. The Hatch Act, furnishing additional funds for the support of scientific work in the domain of agriculture, seems to have been potent in stimulating this new attitude. As a result of the activity of the alumni and of other friends of higher education in the state, the legislature was prevailed upon to change the name to the 'University of Illinois.'

What is in a name? Sometimes much, and so it was here. Giving this name—the University of Illinois—to the institution, if not at that time an indication of a conscious change of purpose on the part of the people of this state, powerfully helped, at any rate, in working out this change of purpose and bringing it to the public consciousness.

It did not, of course, immediately produce large results, and even so late as 1890 the faculty of the school numbered only thirty-five, and the student body, four hundred and eighteen. Since that time, partly as a result of the impetus given by the second Morrill Act of 1890; partly as a result of the changed attitude on the part of the state toward the institution, evidenced, even though unconsciously, in this change of name; still more, perhaps, as a result of that marvelous increase of popular interest in higher education manifested throughout the country in the last fifteen years; the legislature of Illinois has become more and more liberal in its appropriations, enabling the institution to approximate with an ever-increasing rapidity toward the ideal expressed in its name, 'The University of the State of Illinois.'

The increase in the attendance and in the instructing body has been remarkable. The faculty has grown to number nearly four hundred and the total number of matriculants in all departments for the present year will probably reach four thousand.

This rapid increase has been partly the result of adding new colleges—in some cases existing colleges with an honorable history and a considerable attendance, as in the case of the colleges of medicine and dentistry—and partly the result of increased attendance in the older departments.

To the original colleges of agriculture and mechanic arts, contemplated in the first act (including engineering and architecture), have been added the colleges of liberal arts, of science, of law, of medicine and dentistry, and the schools of music, of library science, of pharmacy and of education.

In the college of liberal arts and the graduate school connected with it, are included the ordinary subjects of instruction embraced in the modern university so far as they are not included in the other schools and colleges mentioned, except those belonging to a theological school.

Associated with the university are, besides the agricultural experiment station already mentioned, the engineering experiment station (the first of the kind in the country); the state geological survey; the state laboratory of natural history; the

state entomologist's office and the state water survey.

Such is the university now. What is to be its future? At the risk of incurring the fate of a prophet I will undertake to forecast the future of this institution to a limited extent; and I do it with more confidence because the history of other state institutions has already indicated some of the things in store for us—institutions in whose footsteps we are sure to follow, and if at first *longo intervallo* yet with increasing determination to press them ever harder in all those things which pertain to a true university.

I take it first of all, then, that this institution is to be and to become in an ever truer sense, a university. That, I presume, has been settled once for all by the people of this state. It was settled, even though unconsciously, when the word 'industrial' was stricken out of the title, leaving it simply 'The University of Illinois'—by no means the first time that the subtraction of a word from an expression has indicated an addition to the meaning.

It has been settled anew at each successive session of the legislature, as by one increase after another in the appropriations the representatives of the people in the general assembly have set the seal of their approval on the large and wise policy of the trustees.

It has been settled by the ever-increasing purpose of the great mass of the people of this state, the plain people of the farm and the mill, of the country, the village and the city, to build here a monument which will be to them and their children an honor and a glory forever, an evidence which all the world can see and understand, of their corporate appreciation of the things of the spirit.

What then is a university—that which this institution is to be and become?

Men of different nations and different times would give different answers to this question. Nay, men of the same nation and of the same time would give different answers. In fact so different would be the answer given by different men in the United States at the present time to this question, that one might well wonder whether there is any common agreement as to what a university really is.

I must, therefore, answer this question for myself, for this time, and this place, and this institution without, however, reflecting in any way upon what other institutions bearing this name are or may become. I believe that the system of institutions which shall satisfy the educational demands of a nation like this must embrace higher institutions—universities if you will—of many different types. In sketching out the future of the University of Illinois, therefore, I do so with due regard to the fact that we have in this state important and valuable institutions of an entirely different type whose work the University of Illinois will thus supplement and complete.

I should define a university briefly as that institution of the community which affords the ultimate institutional training of the youth of the country for all the various callings for which an extensive scientific training, based upon adequate liberal preparation, is valuable and necessary. You will note the elements in this definition. By virtue of the function thus assigned to it, it is in a certain sense the highest educational institution of the community. It is the institution which furnishes a special, professional, technical training for some particular calling. This special, technical, professional training must, however, be scientific in character, and must be based upon adequate preliminary preparation of a liberal sort.

By this requirement of a liberal preparatory training, the university is differentiated from the technical school or trade school of secondary grade. By the scientific character of its training, it is differentiated from a mere preparatory 'cram' school for public examinations: such as were so many of our private professional schools down to a recent date.

There are certain things, then, which must mark this institution in order to make it a true university. The most striking peculiarity is the scientific character of the training which it affords. A consideration of this feature—for to my mind it is the fundamental and distinguishing quality of the university—may properly delay us for a moment. There are many ways in which a man may be prepared for a profession. He may have no school training whatever of a special or professional kind. Having acquired a knowledge of the elements of learning, he may be thrust directly into the practise of a profession in order to learn 'by doing.' This has been characteristic of most of our professional work in this country down to within a recent date. But even when schools have been organized to afford such training, they may still be of very different kinds. Thus they may be merely institutions to purvey what is already known in the profession, their purpose being to fill the minds of their pupils with knowledge of what at present is known about the subject in hand; perhaps to enable them to pass a state examination which may be prescribed in this particular field, or to pass a university examination set for the purpose of testing one's knowledge rather than one's power.

A school may, on the other hand, be organized on the theory that the best way to prepare a man for the practical duties of a profession, so far as it can be done in school, is to train him to be an independent investigator in the domain appropriate to the profession. Thus, from this point of view, the best way to prepare a man for a professorship in mathematics would be to train him in mathematics in such a way and to such a point that he might have a power of independent judgment in the domain of mathematical problems; that in an independent way he might discover the possible mathematical problems for himself and be equipped to handle them one after the other as he might have occasion or opportunity to take them up. In the same way the best training for a lawyer or a judge would be such a training in the science of the law as would enable him to have a power of independent judgment on any legal question he might meet, such as would qualify him to take up with entire freedom and with a feeling of ability the investigation of any topic which might come before him.

It is this latter idea which underlies the German university and the German professional school. According to the idea of the Germans the way to prepare a man to become a professional chemist is not to load him down with all the knowledge of chemistry which the world has thus far accumulated, though such an acquisition under certain circumstances may be valuable, but to train him in the field of chemistry in such a way as to make him an independent investigator—one who will be qualified to meet any chemical problem coming up in the course of chemical work. In the same way, to prepare a man to be a professor of history is not, according to the German idea, to fill him up with the knowledge of all historical facts, for such facts have already passed, in their multitude and magnitude, beyond the power of any man to grasp, even that of a von Ranke; but to give to the man a historic

sense, or at least to awaken it in him (for if he has it not it would be difficult to create it entirely anew), to develop his critical spirit, to qualify him to take up the investigation of any particular historic problem in such a way that when he has finished his investigation the last word will have been said, so far as the existing material will permit.

In addition to this, the purpose of the professional school should be not merely to qualify the student to do this kind of research, but to inspire him with an ambition actually to do this kind of work to the extent of his ability, whatever the position to which he should be called.

I do not know to what extent this peculiarity in the conception of a true professional school may explain the leadership which Germany enjoys to-day in the world of science and scholarship, that is to what extent this peculiarity in their educational system has produced this thirst for scholarship and learning, or to what extent their natural thirst for scholarship and learning has worked out this peculiar device for stimulating such a spirit. Whichever may be true, I think we must allow that in this particular quality the German university surpasses those of the rest of the world.

They carry this thought much further in Germany than in any other country. No man is allowed to teach, even in a secondary school of the first grade, who has not come under the influence of the theory and practise of this sort of a professional school. And while the German universities, judged from an American point of view, have many defects, this is certainly one of their strongest points, and one which, if we can in any way secure for ourselves, in our own institutions, would be a great advantage to us.

It goes without the saying that in such an institution as we are outlining the faculty will consist of men and women who will have developed this quality of scholarship, this idea of learning, this notion of productive work in the field of scientific investigation and research. It can not be anything else and accomplish the ends we have in view. Now, of course, there is a long road to travel between our present situation in this respect and that time when, judged from this point of view, we shall be a true university. I say a long road, but it will be covered, I fully believe, in a comparatively short time; for the idea of this advance has already permeated this body of instructors, has touched with its dynamic force every aspiring soul in the group and will in the long run leave no individual untouched, and will leave no person unaspiring.

What this spirit, if it could become general, would mean for our scientific advance as a nation, what it would mean for our industrial improvement, surpasses almost the power of the human mind to conceive. Suppose every one of our high school teachers in this country had had a university training in the sense in which I am using the term, so that when he goes into a community and begins his work of instruction there also goes into that community a new power, a new force, being itself first of all productive, and then aiming to select from that community the young minds which may have it in them to add to the power and resources, to the wealth, moral, intellectual and material, of their communities, and kindle in them the sacred flame of aspiration, as only the genuine fire of scientific enthusiasm can kindle it. Suppose every student who goes forth from this chemical laboratory should carry with him the power and the determination to add something to our knowledge of chemistry, what an addition to the industrial resources of this country! It would mean

more than the annexation of many fertile islands beyond the sea, and would cost far less.

In brief, then, this institution must become, in all departments of professional life, a great center of scientific research and investigation, and must become so, if for no other reason, because the professional training itself can not be of the highest type unless it be given by men who are qualified for, and eager of, scientific effort.

This university will include within itself not merely the old professions—law, medicine, teaching—but it will include scientific preparation for any department of our community life, for the successful prosecution of which an extensive scientific training of this kind is desirable or necessary. We shall add, therefore, from time to time schools or colleges which will take care of these new professions as they may appear. We have already begun with the profession of engineering in all its various forms—mechanical, civil, electrical, sanitary, chemical, etc., the profession of architecture and the profession of farming. The next to be entered upon in a large and satisfactory way is the profession of business. Some of these newer callings are, of course, quite different in their character, and will call for quite a different kind of training from that of the old so-called learned professions. It will hardly be possible to turn through the halls of our universities, even though they be multiplied many fold, all those who expect to enter in one capacity or another the great world of business. And for many a long day to come the great geniuses in this department will probably be men who have had no university training; for the 'wind bloweth where it listeth' and many a genius will sprout and bud and flower in this domain who has not seen even the outside walls of a preparatory school or college or university. But we have already reached the time when the subject matter relating to the world of business has a content which is susceptible of scientific treatment, the study of which, under proper conditions, may become a valuable element in the preparation for business. The time has come, therefore, when the college of commerce should be one of the constituent colleges of the university.

So I expect to see this institution increase the number and quality of its professional schools as the years go on, until it will have developed into a full-fledged university of the broadest scope, capable of answering to the multiform needs of a great commonwealth.

In a word, this institution will most fully perform its duty to the people of this state if it will stand simply, plainly, unequivocally and uncompromisingly for training for vocation, not training for leisure—not even for scholarship *per se*, except as scholarship is a necessary incident to all proper training of a higher sort for vocation, or may be a vocation itself, but training to perform an efficient service for society in and through some calling in which a man expresses himself and through which he works out some lasting good to society. Such training for vocation should naturally, and would inevitably, if the training were of the proper sort, result in the awakening of such ideals of service as would permeate, refine and elevate the character of the student. It would make him a scholar and investigator, a thinker, a patriot—an educated gentleman.

It is apparent to any one who knows the present condition of the university, and for that matter of any of our American universities, that such a conception as this calls for a continued growth at the top and a lopping off at the bottom. In other words, it requires an increasing standard

of admission to the university, and an extension of the scientific character and quality of the work done inside of the university. And this development I consider will be as inevitable as the ebb and flow of the tides. My own idea is that the university ought not to be engaged in secondary work at all; and by secondary work I mean work which is necessary as a preliminary preparation for the proper pursuit of special, professional, that is scientific, study. Consequently, our secondary schools, our high schools and our colleges will be expected to take more and more of the work which is done in the lower classes of the various departments of the university as at present constituted, until we shall have reached a point where every student coming into the university will have a suitable preliminary training to enable him to take up, with profit and advantage, university studies, in a university spirit and by university methods.

Every community in this country ought to furnish the possibility of securing this secondary training as near as possible to the heart of the community itself. Certainly every town of fifty thousand inhabitants, and, perhaps, every town of twenty thousand in the United States—surely every county in this state—should be able, through the activity either of public agencies or of private beneficence, to offer the facilities for acquiring this secondary grade of education which is appropriate to the high school and the college. Surely it is true that the work done at present in the freshman and sophomore years at the University of Illinois, and for that matter in any of our American universities, may just as well be done, so far as the quality of the work is concerned, at any one of fifty or one hundred centers in the state of Illinois, as at Urbana; provided only that adequate provision be made for giving this instruction. And this adequate provision need not be very expensive. There comes a time, in the growth of attendance at any institution, when it reaches its maximum efficiency. I have no doubt myself that in another ten years, unless we should have some great economic backset, there will be ten thousand students in the state of Illinois, who will want the kind of work and the grade of work offered in the freshman and sophomore years of the University of Illinois. Now it is to my mind perfectly apparent that it would be undesirable to have ten thousand freshman and sophomores in the State University at Urbana. It would be far better to have them scattered over the state at fifty other institutions, provided we can get these institutions to take care of them properly, and then send those of them who may desire the more advanced work up to the university.

So then, the institution must be lopped off at the bottom and expand at the top in order to become that true university of the state of Illinois which will render the largest service to the people of this community. We have, in the development of our college of agriculture a very excellent illustration of how, with the growing standard of this state, an individual professional school will gradually change its entire character by the continued raising of its standards. Thus far, we have been practically accepting in the college of agriculture any young man who desires to avail himself of the advantages for instruction offered here, and who seemed to the faculty likely to be able to do the work, without reference to his formal preparation. At the present rate of growth, in another ten or fifteen years there will be five thousand young people in this state who will want to pursue these studies. It would not be possible or desirable to take care of these five

thousand people in the college of agriculture at Urbana. I expect to see secondary schools of agriculture established at different points in the state where those who wish technical work of secondary grade can secure it near home, and from these the best trained and the best fitted will be sent up to the college of agriculture at the University of Illinois for their advanced training.

One may ask, at what point will you cease to raise these standards of admission? I think the answer to that question is very simple, namely, when we shall have succeeded in requiring from the young men and women who enter the university that degree and kind of preliminary education which, from a pedagogical and a social point of view, best qualifies them for the beginning of special, *i. e.*, scientific, training.

You will see from the above sketch that I look upon the university as an institution for the training of men and women, not of boys and girls. The latter, I think, is distinctly the work of the high school and the college, and the sooner it can be relegated to them, the better for the young people themselves, for the schools and colleges, for the universities and for the community. I have no doubt myself that when our educational system is as fully developed as is our commerce and our manufacturing, we shall see this differentiation of function.

But this institution will be and become not only a university in general, but it will perforce be a particular kind of a university. It is and will remain a *state* university, and certain consequences for its future flow from this fact.

The first thought in this connection is one of limitation. As a state university in America, there are certain things which it can not undertake, at least within any period which is worth our while to prognosticate for it. The old traditional university of the middle ages and later times consisted primarily of the three faculties of law, medicine and theology. The philosophical faculty was later added and in a few instances still another faculty was added, making usually four and sometimes five in the typical university.

The theological faculty was thus from the beginning an essential part of the university. It was an element of the university idea. A university without the theological faculty can hardly be looked upon, from a theoretical or historical point of view, as a complete university. Certainly the vast majority of thinkers would say that the absence of a theological faculty is a serious defect in an institution which aims to be a complete university. From the standpoint of the church I have always felt that it was a great disadvantage for it to educate its priests or clergymen in theological seminaries isolated and monastic instead of in theological faculties forming part and parcel of a great university which is itself in many respects a microcosm and life in which prepares for the great life of the world outside.

But in this country, of course, the state university can not undertake to establish a theological faculty for a long time to come, if ever; in fact, not until there is a substantial agreement on the question of religious beliefs and practises, at least so far as fundamentals are concerned. This day is certainly far in the future, and until it comes, the state universities in this country will certainly not organize or support theological faculties.

But we have gone somewhat further in our actual practise than our theory of separation of church and state might call for and we have cut from our curriculum of studies all courses bearing upon religion, even upon the history of religion.

I can not help thinking myself, that this is a serious limitation both to the university and to the church, none the less real and serious, because under our circumstances it may be necessary as a condition of development of the highest usefulness of the state university.

Let us not make a mistake here, however. The cutting out of formal religious instruction from the curriculum does not mean that a state university is necessarily non-religious, or anti-religious. An institution is religious or the opposite chiefly because the community of which it is a part is religious or the opposite. The character of the state university, like that of all the other institutions of the country, will be determined fundamentally by the character of the people itself. How true this is in matters of religion may be seen by the actual facts concerning our state universities. Thus, all of you who have followed the work of the Young Men's Christian Association must have been struck by the fact that it has no more active and vigorous centers of life than those in our state universities, and the international secretary of the association stated some time ago that the largest, strongest and best organized college Christian Association in the world was to be found here among the students in the University of Illinois. Religion, the religious spirit, the reverent attitude and all which is bound up with what is best in religion is not something, of course, which can be shut up within the dry bones of statistical tables, and yet the figures collected by our young people who have been interested in this matter show that there is very little difference between the number of students who are members of the church, for instance, at our state universities and at the other great educational institutions of the country—which would seem to bear out my proposition that the fundamental fact is not after all the presence or absence of religious instruction, but rather the character of the community from which the members of the state university are drawn.

At the same time, any one who is a believer in the state university and its function can not help regretting the feeling which certainly has prevailed in certain circles in the past if not in the present, that the state university is in a certain way anti-religious in its atmosphere and its work; for we can not close our eyes to the fact that whatever you or I as individuals may think of religion and religious training, the great mass of the people of this nation are deeply concerned that their children should be brought under what they conceive to be proper religious influence early in life, and should remain so throughout the college and university years.

It is then a matter of congratulation to those of us who have seen in this opposition to the state universities a certain menace to their prosperity, that there are many signs that this particular difficulty is going to be met in what will be an extremely satisfactory way to all concerned. The great religious denominations have come to recognize that these institutions are destined to grow and increase with every passing year, and that the state of which they themselves are a part will never agree that the principle of the separation of church and state shall be infringed upon to the extent of providing religious instruction in state universities, and that therefore the duty is upon them to see that adequate provision is made for this great need. They are solving it in different ways. They are in some instances erecting guild houses and dormitories where the children from the families of their particular faith may find centers of influence and help. In other places they are providing lectureships upon religious subjects for the bene-

fit of any students who choose to attend. In some places they are beginning to imitate the Canadian system so well exemplified in the University of Toronto, of organizing local colleges with the specific purpose of offering instruction in religious topics and in other subjects which the state university may not adequately support for the benefit of students who desire to take such work.

For my own part, I believe some such device as this last named will be found to be a very satisfactory and helpful one, and that by this means we shall solve this problem, which is none the less real and serious because we have too often been inclined to close our eyes and ears to the facts and refuse to consider the question, imagining that if we could only bury our heads in the sand we should be free from the necessity of meeting it and grappling with it. When we can combine the freedom of the state university with the opportunity for instruction in religious matters which the great mass of our people holds to be desirable and necessary to true education, we shall have taken a long step toward solving not only this particular problem, but many others which touch it and ramify from it in many different directions.

But if the first thought growing out of the fact that this is to be a state university is one of limitation, the second and prevailing thought is one of freedom, of privilege, of ease of movement, of facility, of adaptation.

No one will certainly accuse me of underestimating the work or importance of the non-state university. I owe my own education entirely, after leaving the public high school, to the non-state school, particularly to the denominational, if not sectarian, school, and my own work as professor and president has been, until I came here, entirely in connection with such schools. Northwestern, Harvard, Pennsylvania, which though in name a state, is in fact a private institution, and Chicago represents the course of my student and professional life. No one, I believe, can entertain a deeper feeling of gratitude to these institutions and to the men who have founded and built them up, than I. No one can have a higher appreciation of the value of their services to the community than I, and I may say that the more I learned about each of them, the more I was impressed with the magnitude of their service to the community.

The University of Chicago, for example, has not only done the ordinary service which any well equipped institution of higher learning does, but it has played a most important part in advancing the standards and educating public sentiment on higher education throughout the Mississippi Valley. It is not too much to say that every institution of college or university grade in the middle west has profited directly or indirectly by the magnificent work of this institution—and by no means the least among them, the University of Illinois. It may not be out of place for me to say that the University of Chicago has been in large part, from this point of view, William R. Harper, whose absence we so much regret on this occasion. If Chicago University had done nothing else in the last fifteen years than provide an opportunity for the blessing-bringing activity of William Rainey Harper it would still be worth to the community all it has cost.

But even if I owed no personal debt or obligation to these institutions, if I had never for an hour enjoyed the benefit of instruction within their halls or from any one who came from them as teacher, still I should certainly be a blind, ignorant guide indeed if I should by any remark of mine belittle these institutions or derogate in any way from the glory which properly belongs to them. We believers in

state universities, whatever we may think of the future, must certainly acknowledge that we owe everything that we have been, and almost everything that we are, to these non-state institutions. If the history of American education were to be closed to-day, certainly the chapter devoted to the work of the state university would be very short and unimportant, indeed, as compared with that which should relate the history and services of the non-state institutions—Harvard, Yale, Brown, Columbia, Princeton, Leland Stanford, Dartmouth, Oberlin, Johns Hopkins and the hundred others—what a galaxy! and how proud we all are of them and their work! No thoughtful man, it seems to me, however much he may desire that our state university should wax, would like to see these non-state institutions wane, and I believe we should all feel that anything which would injure the efficiency or the work of any one of these institutions would be a calamity pure and simple.

In my own view, Northwestern, the Armour Institute of Technology, the University of Chicago, Milliken University, and the score and more of other non-state institutions engaged in the educational work of this state, are a vital, fundamental and essential part of the life of this community. I can not, of course, foresee how many of the numerous small colleges in this state are destined to survive. Some of them, perhaps, may disappear. Others, I believe, will be newly founded. All of them, and more too, will be needed when the population of this state shall be ten millions, as it will be before many years. But even for the present I can not help feeling that any means by which such institutions as Lake Forest, Knox College and the Wesleyan and McKendree and Illinois and Shurtleff and St. Ignatius and a dozen others can be enabled to do their work in a thorough and efficient manner, will be a cause for congratulation to every lover of education. We are all part of the same enterprise, engaged in working out the educational problems of this great commonwealth, and that enterprise is going to be the greater and the more glorious in proportion as each of us is enabled to do fully and faithfully his part and portion in the work.

I am a great believer in the desirability, nay, from certain points of view, the necessity, of a complete scheme of state education from the kindergarten through the professional school. I believe the state owes it to itself, to its own people, to the nation, to provide such a scheme of education.

But I have never felt that the system of state education should be monopolistic in character, should be exclusive, *i. e.*, should try to cover the entire territory and the entire field to the exclusion of church or private agencies. The extent to which the private institution has been driven out of the field in Germany and France has been and is a serious intellectual, material and spiritual loss to both these countries. On the other hand, the extent to which higher education has been left entirely to private hands in England has been equally serious and damaging to the interests of that country. The extent to which we have brought about a cooperation between the principle of public and private initiative in the field of higher education is a striking illustration of our good fortune, if not of our insight—for after all it has been largely accidental. It is desirable that the state of Illinois should have a state university, no matter what the church or private individuals may do, no matter how many institutions these may build up by its side. It would be equally *un*desirable if the state of Illinois should attempt by either direct

or indirect coercion to drive everybody desiring higher education into the state university. Northwestern University, and Chicago University, and the Armour Institute of Technology, and Milliken University and the many small colleges in the state are taking care of students of college and university age, in the aggregate far in excess of the number provided for in the state university. And in my opinion they always will, and, further, they always should.

In other words, while I am a firm believer in the principle of a state system of education from the lowest grade to the highest, I believe also thoroughly in utilizing, as far as possible, the assistance of all other agencies in the same department of education. And this cooperation will, in this country, for aught that we can see, for an indefinite period be not only desirable, but necessary to meet our educational needs.

It is the non-state institution then in England and in this country which has been in a certain sense the 'ark of the covenant,' which has carried on from generation to generation the precious deposit of learning and has been the intermediary by which the spiritual possessions of the past have been carried over and made the possessions of the present.

Endowed institutions, whether under private or church control, have thus done a vast service. But, on the other hand, they have the defects of their virtues. Educational institutions, whether private or state, are by nature conservative. They resist changes and improvements. They fight progress almost as by a law of their being, and the greater their endowments, the more completely they are removed from the necessity of appeal to the life of their own generation for support, the more set do they become in their conservatism, the more bulwarked in their opposition to all progress. They may by their wealth defy the currents of progress. They may oppose themselves to all forward movements. Not only may they do so, but in nearly every instance in history they have done so. The history of every European country demonstrates that these bodies, the universities and colleges, have had to be reformed by law. Left to themselves they have suffered of dry rot in an extreme form. Oxford and Cambridge fought bitterly all attempts to force them into line with modern progress. It was the forcible subjection of the German university to the directing power of the government which broke up the crust of conservatism and paved the way for that wonderful career of progress which put Germany at the head of scientific progress. Even in our own country our colleges and universities have the same opposition to education and progress to record. If the people in this country had handed over to college and university faculties the decision of the important educational questions which they have had to settle in the last fifty years, we should have to-day practically no high school system, or one of comparatively little value. We should have no system of state universities. We should have, to a large extent, no professional schools of high quality at all. It is, indeed, a question whether we should have even an efficient free common school system.

Fortunately for us, however, our institutions as a whole have been so poverty-stricken that they have been compelled to appeal to the community continually for funds, and in doing so they have been forced into lines of progress which have become more and more evident in the past few years. I am a great admirer of Harvard University, easily the greatest of our universities; I am a great admirer of Harvard professors, and especially of that

great man, the present president, *facile princeps* among the leaders in American education of the last twenty-five years, Charles W. Eliot, but I do not believe there has ever been a time, down to within a very recent date, when, if the faculties of Harvard College could have had absolutely their own way, and had had money enough to persist in their own way, they would not have committed themselves squarely against every question of educational progress which the scope of the times has brought to them. And what is true of Harvard is still truer of the less progressive institutions of higher learning, of which we have many.

So I believe it is necessary, friends, by the side of this system of private, endowed, church institutions, to maintain a system of state institutions. By the side of these other great institutions of learning it is necessary in this country to maintain the state university, which, because of its entirely different origin, because of the different influences to which it is subject, can work out a supplemental scheme of education in many different directions, extending into many fields which would be neglected in all probability by these other institutions. Such an institution, even though not a leader by choice, will by its very constitution be compelled to adjust itself to modern demands and thus force the other institutions which wish to exist by its side into a larger and more liberal view, and finally into what is clearly the line of progress.

The state university is necessary in order to help maintain the democracy of education; to help keep education progressive; and finally in order to keep higher education close to the people, and make it the expression and outgrowth of their needs.

As a *state* university, we may properly demand from this institution that it undertake certain functions which it is not so easy for other institutions to assume.

This institution as a state university may become more directly and immediately the external expression of the corporate longing of the people for higher things in the sphere of education than can any other type of institution. This is said with all due regard for and due recognition of the real way in which the private institution has entered into, and is a real expression of, the life of our people. Fortunately, we have never needed to fear, in this country, what some of the continental nations seem to have feared, namely, that institutions of learning under private or church auspices would work against the public interest of the community of which they are a part. The fundamental object of all institutions of higher learning may be summed up from one side, as the creation of the highest and most efficient type of citizen. And fortunate it is for us that we may truly say to-day, as in all previous periods of our national history, that all our higher institutions of learning, whether founded by private individuals or by religious sects, have in this respect worked out the same beneficent result for the community; that the graduates of all these schools alike have been to the same extent good citizens, have been devoted patriots, have been self-sacrificing and public-spirited members of society.

And yet I can not help but think that an institution, in the establishment and endowment of which every citizen feels that he has a direct and immediate share, expresses in a certain way more fully his desire for higher things in the field of education than can any other type of institution.

As the citizens by their combined effort make it possible to raise the standard, enlarge the outlook and increase the equip-

ment of such an institution, they are by this very act themselves widened in their own outlook, enlarged in their own sympathies, quickened in their own higher life. And as this institution is thus made more efficient, it again in turn reacts upon the quality of its clientele and its constituency by turning back into its midst an ever-swelling number of young people, who in their turn by their higher education and their more efficient training raise the level of the society from which the institution springs. And so there is a real moral influence, and a real moral power proceeding from this relationship between the state university and the citizen, which is none the less real, none the less effective because, like all spiritual things, it is impalpable, and, to a certain extent, elusive. And just as the creation of the public elementary school opened a new era in the consciousness of the American people as to its duties toward education, just as the creation of the public high school has opened a new outlook, established a new consciousness on a higher plane of the duties of the community as a whole in the field of secondary education, so the creation of the state university has marked a new, a forward, an upward step of no mean importance and no mean power. It is a great step to get a whole people to recognize in its corporate capacity that one of its fundamental duties is higher education, and that one of its fundamental purposes should be the creation of organs of activity which should realize and carry out this fundamental function. It means that the whole people has passed on into a new and a higher state. It is no longer an appeal to a man as a Christian that he should look out for the education of the community of which he is a part, and to which he owes a duty—surely a high appeal—it is no longer an appeal to the Baptist or the Methodist or the Presbyterian that he owes it to the church and that the church owes it to itself to look out and provide for the existence of church institutions of higher education—surely a high appeal—nor is it merely an appeal to him as a philanthropist, striving as an individual to return to society some part of the wealth he has achieved; but it is a far more fundamental, a far more universal appeal to him in his capacity as a member of society, whether Catholic or Protestant, whether Baptist or Presbyterian, whether rich or poor, that this duty to assist higher education is as complete and all embracing and fundamental as any other duty of citizenship. There is no doubt that when a community reaches this point of view it has passed onward and upward into a new and a higher state of educational consciousness with an ever wider educational outlook, and with the promise of undreamed of visions in the years to come.

It is a necessary part of the idea of a *state* university that it shall be an organic member of the state system of public education, and that while, therefore, in a certain sense it is the crown of this system, it must rest solidly and securely upon a sound basis of secondary and elementary training. No state university can become the most efficient instrumentality for educational work within its jurisdiction unless it is built up upon a sound system of elementary and secondary schools from the kindergarten to the university itself.

It follows from this that the university must itself be an active organ in developing, if necessary in creating, in refining, in elevating, the character of this elementary work; for without it the university can not become a true university at all.

It follows, moreover, that the university must be most intimately and continuously associated with the scheme of elementary

and secondary education. It must be so immediately based upon it that there shall be no gap between the university and this scheme of preparatory work.

From this, several consequences follow, some of them beneficial and some of them, if not injurious, at least antagonistic in a certain sense to the highest and most rapid development of the university.

The state university can not require for admission what the secondary schools of the state can not give, and if these remain few in number, and of a low type, the university itself must be content with living upon a lower plane of usefulness than would otherwise be the case.

It is a natural outgrowth, therefore, of this essential fact that the state universities were the first of the higher institutions to get into close organic touch with the great element of the secondary system, known as the public high school, and that they have worked beneficently upon this system of lower schools, sustaining, lifting and improving it.

It follows, also, from this that the state universities were the first to find it necessary to adapt their own requirements of admission, to adapt to some extent their own curriculum, to the needs of these secondary schools which have a much wider function than that of simply preparing for the university. And so the state university has been determined in its educational policy by the needs of the secondary school itself, thus bringing about a most intimate relation. The result of this intimate relation between the state university and the secondary schools has been that the university in all the states where it has been put upon the proper basis, has been the most active and energetic influence urging the community to develop in an adequate way the secondary school system.

The statement is sometimes made by opponents of large appropriations to the state university that you had better spend more money on your lower schools, and less on your higher, if you desire to improve the educational quality of the public school system. No graver mistake could be made than that which is involved in the ordinary understanding of this proposition.

You can not have good kindergartens unless you have good primary schools. You can not have good primary schools unless you have good intermediate schools. You can not have good intermediate schools unless you have good high schools. You can not have good high schools unless you have good universities. In other words, no community reaches the upper grade of efficiency in its elementary schools, except by establishing and improving the quality of its higher schools. This is so apparent to a student of education, and seemingly so difficult of comprehension by the general public, that a further word may not be out of place.

Suppose a state had ten millions of dollars to spend on its school system. My proposition is that a considerable portion of that should be spent upon the highest grade of the system, the university, in order to secure the effective expenditure of the money in the lower grades, and that if you were to spend ten millions of dollars upon your primary schools and nothing upon your higher schools, you would have a far inferior system of schools to what you would have if you provided for an adequate scheme of higher institutions.

Certainly you can not have good schools unless you have good teachers, and all our experience shows that you can not have good teachers in any grade of schools unless you have good schools of a higher grade where these teachers may secure their preparation. Moreover, there is a subtle moral force ever at work in school

matters which makes it impossible to secure the highest point of efficiency in any grade of the school system unless it looks forward to and prepares for something higher. You can not have good schools of an elementary grade unless there is the opportunity for your best pupils, for those who have the time and money, to pass on up to ever higher grades of study. This is the justification of the high school, the college and the university from the standpoint of the eighth and seventh and sixth and first grade of the elementary school.

As a *state* university this institution will have intimate relations not merely with the high schools and elementary schools of the educational system, but with the other great element of the secondary scheme, namely, the normal schools.

Many people have thought that the normal school is in a certain way merely a temporary element in our educational system. It is intended to train teachers for the elementary and secondary schools. And there is a feeling in many quarters that as our high schools improve in quality and our universities multiply, the necessity of our normal schools will disappear.

I have no doubt myself that the normal school will change profoundly its character in the course of years, though how it will change I do not profess to know; but that it will, within any time for which it is worth our while to plan, become a superfluous element in our scheme of education I do not believe at all. Develop our universities as much as we may be able, develop our colleges as much as private enterprise and church initiative may assist us in doing, we shall still not be able to secure for our elementary and secondary schools an adequate number of properly trained men and women without the assistance of these normal schools.

I believe that they should stand in the very closest relation to the state university, and I believe that it should be possible to organize their work in such a way that persons who intend to prepare for the work of teacher in the elementary and secondary schools of the state, and for the position of superintendent and other similar administrative positions, should find it possible to pass either through the normal school and then through the university, or through the university and then through the normal school, as they may find it most convenient. I believe that all our universities would find it to their advantage to get into touch with this great normal school system, but for the state university this is an absolute essential.

The state of Illinois has established five great normal schools and has equipped them in a most liberal way, and will continue with increasing liberality to keep them fully abreast of the times. They are doing a work which no other element in our school system is doing, and I expect, for my part, to see them improve and grow rather than decrease, and the state university and the normal school together will form, if you please, a single institution for furnishing, in the most efficient and economic method practicable, properly trained men and women for the great system of public schools supported by the state.

But the state university, it seems to me, must proceed further than I have thus far indicated, and with one or two brief suggestions as to some of the directions in which the state university will develop, I shall bring these considerations to a close.

The state university will become more and more a great civil service academy, preparing the young men and women of the state for the civil service of the state, the county, the municipality and the township, exactly as the military and naval

academies are preparing young men for the military service of the government.

The business of the government is becoming more and more complex with every passing year. The American people is beginning to take a new attitude upon the subject of its civil service. Formerly it was thought that anybody who could read and write was fit for almost any position in the service of the state, and for a long time in the history of the country it was thought that the most practical method of selecting men and women for positions in the civil service was by their affiliation with and devotion to political parties or political factions. We are coming to a recognition of a new state. The abuses of politics have led the American people to the general acceptance of a principle, very far from being worked out as yet, under which men and women shall be selected for the civil service by a method which shall eliminate the element of political affiliation (I am speaking now of the administrative positions in the narrow sense of that term), and every passing year sees some new strengthening of this principle of the so-called merit system under which people are selected for posts in the public service on other grounds than that of party devotion.

But we shall not be satisfied very long with this condition of things. Public administration is becoming with every passing year a more complex subject. It calls for special knowledge. It calls for the trained mind and the trained hand. It will not be long, therefore, until the American people will, for many positions now practically open, insist that the holder shall be properly trained and qualified to perform the duties of that particular office; and now that the state offers every opportunity to secure an education not merely in the elements of learning, but in the secondary and higher grades as well; now that the state offers an opportunity to procure practically free the technical training necessary to qualify people for these posts, we may expect to see more and more a standard of efficiency set up and insisted upon by the people of this state, for all persons entering the public service. In an age of excellent courses in civil engineering supported by the state almost free of charge, we may expect to see the state require that the civil service aspirant in the field of surveying, for example, shall be a man of scientific training, not merely one who has learned his business by mere rule of thumb. We shall expect to see every municipality demand and employ men of careful scientific training to test its water supply and its food supply. In other words, the time of the haphazard, happy-go-lucky, hit or miss public official and of the ignoramus in the department of public administration is passing away in favor of the scientifically trained man who knows his business. Now the people of this state have a right to demand of the state university that it shall turn out men and women properly equipped for this kind of work, and who will return to the state in efficient service a thousandfold over, the cost of their trainng.

Now, all this you will note is in addition to and quite apart from the function of the state university as a center for the training of men and women who wish to enter the learned professions, a topic which has been discussed previously. To my mind, if the state requires an examination of proficiency from anybody as a condition of practising any profession, it should itself provide the centers properly equipped, where the requisite training may be obtained. And as the state may undoubtedly increase this supervision over callings now left free, we may expect to see the state, in the state university, provide opportunities for study in many directions which are not now to be found at all.

But the state university must be and become more than a civil service academy. It is and is destined to become to an ever-increasing extent the scientific arm of the state government, just as the governor and his assistant officers are the executive arm and the judges and the courts are the judicial arm.

As the business of government becomes more complex, the problems which the state has to solve in many different directions become more difficult, requiring in many cases most careful scientific experimentation and long-continued investigation, for the pursuit of which there must be adequate laboratory equipment and trained investigators. For all such work the state university is the natural and simple means already provided.

I have called attention to the fact that here in the University of Illinois are already located, for example, the state water survey, the state natural history survey, the state entomologist's office, the state geological survey, etc. There is no doubt that if the university is properly organized to undertake this scientific work in a way to make it thoroughly effective, it will, to an increasing extent, be constituted the scientific arm and scientific head, if you please, of the state administration.

It goes without the saying that this concentration of the scientific work of the state government at the university has most valuable educational results. The increasing number of scientific men centered at the universities helps create that scientific atmosphere, that scientific spirit which is absolutely essential to the upbuilding of a great university. This union of scientific investigation and educational work is a most fortunate combination for both sides of the enterprise. The scientific work for the state government offers an opportunity to train the young men in actual practise, and by thus securing their interest in and training for such work the government is able to obtain an ample and regular supply of properly trained workers in this field. By such a union the state secures the maximum of service at a minimum of cost.

Further, the state university will, I believe, in combination with the normal schools become practically, for many concrete purposes, the state department of education. We have already in this state and in most of the American states a state department of education, consisting usually of an officer called the state superintendent of public instruction. His duties, however, are comparatively narrow, as prescribed by law. The possibility of performing them is determined by very meager appropriations. Usually speaking, it is an office entrusted with the enforcement of the school laws and the distribution of the school money. The functions of the public ministry of education such as one finds in so many of the European states either are entrusted to him in a very small degree, or he is enabled to carry out these functions only within very narrow limits. The duty of canvassing the educational needs of the state from time to time, urging and impressing them in a strong way upon the people of the state, not merely upon the teachers and the legislatures and the government, but upon the great masses of the people—this is something which our American departments of education have done only to a very slight extent. Now and then a strong personality in the position of state superintendent has worked out great things for the education of the state. We have an example of such a personality in the superintendent's office of the state at present. But there is need of a more continuous, of a wider spread, of a more deeply rooted, activity in this direction, than the state superintendent's office under existing conditions can develop. Such a

function, within certain limits, I believe the state university combined with the normal schools can perform. The department of education in the state university organizing the resources of the state university for this particular purpose may bring to bear upon the educational problems and upon the educational needs of the state, an expert opinion which it is not possible to find in any other department of the state administration.

This function, it may be said, is not performed by the university in its capacity as a civil service academy, preparing teachers for the educational service of the state. It is larger and wider than this. It is a recognition of the university as one of the organs created by the state for determining, within certain limits, the policy of the state in the great field of education.

And thus I might proceed with a summary of other great things that are waiting for the state university if it only knows the day of its visitation; if it only measures itself up to its opportunities; if it only performs faithfully and simply the duties which the state thrusts upon it.

But time presses and I must draw these considerations to a close. I have left untouched many things you may have expected me to discuss, not because I do not consider them as important, but either because I regard them as so fundamental that we should all agree upon them or because the limitation of time does not permit even their mention. You will have gathered from what I have said my conception in general of the function and future of the state university.

It may be defined in brief as supplementary to the great system of higher education which private beneficence and church activity have reared, and it is to be hoped will continue to rear. It is corrective rather than directive; it is cooperative rather than monopolistic; it is adapted for leadership in certain departments, but must look to the non-state institution for leadership in others. It should be as universal as the American democracy—as broad, as liberal, as sympathetic, as comprehensive—ready to take up into itself all the educational forces of the state, giving recognition for good work wherever done, and unifying, tying together all the multiform strands of educational activity into one great cable whose future strength no man may measure.

Edmund Janes James.
University of Illinois.

SCIENTIFIC BOOKS.

Structural and Field Geology, for Students in Pure and Applied Science. By James Geikie, LL.D., D.C.L., F.R.S., etc., Murchison Professor of Geology and Mineralogy in the University of Edinburgh, formerly of H. M. Geological Survey, author of 'The Great Ice Age,' 'Prehistoric Europe,' 'Earth Sculpture,' etc. New York, D. Van Nostrand Company. 1905.

This is a well-made and attractive volume of just the maximum size which long experience has shown to be the largest permissible for a handbook. It is of exactly the same dimensions as the first volume of Chamberlin and Salisbury, and although by the choice of a thinner paper the American book numbers two hundred more pages, it contains so many more figures that the text of the two is of about the same length.

Although the two books take opposite points of view, the one describing structures with little explanation, the other discussing processes with brief illustration, it is interesting to compare them. The Scotch book is as conservative as Edinburgh, the American as radical as Chicago. The former proceeds along the ancient ways with a leisurely fullness that is very attractive to a veteran, and recalls the time when he devoured Jukes or Nauman. The rock-forming minerals are described in detail, and the rocks with even greater fullness. The word petrography, with

all its synonyms, is omitted with much of the complex nomenclature and special doctrines of this new and aspiring science, while the American authors present a grand chapter on the 'Origin and Descent of Rocks,' starting with a molten magma (but discrediting a molten globe), and presenting the new quantitative classification of Iddings and Washington.

Fossils are next treated with great brevity in an excellent chapter of twelve pages. Much is omitted here that appears in Pennell, Cole and Keilhack and might have been expected in a manual of field geology. The book is rather planned for an advanced course in geology in Scotland with some field work, and it is interesting to note the classes for which it is intended according to the enumeration in the preface, viz., mining engineers, civil engineers, architects, agriculturists and public health officers.

There follow chapters written with great fullness and clearness upon the main geological structures, stratification, concretions, folding, joints and faults, the structure of eruptive rocks, and ore formations. The book is here at its best. The illustrations are abundant, well chosen and clear and the plan of printing many of the important figures as separate plates is used with especially good effect and several of the landscapes combine the highest artistic beauty with the greatest illustrative value. Several companion plates are very effective, for instance the field data of a complex area are presented on one plate and the completed map on an opposite plate. Again the tracings of thrust planes are given on a photograph of a mountainside and a section of the intricate geology of the mountain is given on a plate facing the first.

The chapter on metamorphism is brief. The Archæan is dismissed with a half page, and the line of treatment is not greatly influenced by the remarkable attempts to apply the laws of physical chemistry to the problem made by Van Hise, Grubenmann and Becke.

Then follows a chapter of fifty-four pages on geological surveying, which, as it is largely given up to the description of structural features, and, indeed, contains the only discussion of the glacial formation, offers only rather brief and general directions for field work.

The economic aspects of geological structure are then taken up in a very detailed and interesting way, full of practical suggestions for the application of the ideas developed in the preceding chapters.

The book closes with a brief chapter of thirty pages covering the whole subject of denudation and the evolution of all the surface features of the earth, and there is no suggestion of the survey or special field study of these subjects. The contrast between the two books comes out strongly here. The American book devotes 355 pages to the work on air and water and 38 to structural geology. The other gives 30 pages to erosion and 166 to structure. The author shows a great and, in the main, wise conservatism in the employment of new terms. Peneplain does not appear, nor any of the superabundant and largely anthropomorphic terms used especially in America in the description of topographic forms and the cycle of their growth. At the same time he gives with brevity a clear description of the river cycle. The author is, perhaps, not quite consistent as he uses the new or rare word 'phacoids' for 'augen,' which is fully as bad as phenocryst. He seems to wish here to avoid the German, but in another connection uses lee-seite and stoss-seite, when lee-side and stoss-side are good English. In still another connection the word hornfelses has an unattractive look.

In this large book, given up almost entirely to the presentation of facts, the reviewer has wished to criticize only one minor statement. It is said (p. 51) "Tachylite is altered to a yellowish or reddish substance known as Palagonite." Palagonite is certainly an original volcanic glass which has cooled with its present large content of water. A certain uncertainty inherent in the subject may be noted in the treatment of amphibolite and hornblende schist. The two volumes thus supplement each other in a valuable way, the one being a full and well-considered hand-book for use in the sober work of geological surveying or economic investigation, in a country like Scotland, where there are no active volcanoes,

earthquakes or glaciers; the other a bold and stimulating guide in every branch of research concerning the evolution of the earth.

B. K. Emerson.

Amherst, Mass.

The Students' Laboratory Manual of Physical Geography. By Albert Perry Brigham. New York, Appleton. 1904.

This is an expansion of the 'Teachers' Guide and Laboratory Exercises' published in 1903, and like it designed to accompany Gilbert and Brigham's 'Introduction to Physical Geography,' to which it is very closely adjusted. It is about half as large again as the 'Teachers' Guide,' but omits the lists of books. It is purely for the student and implies the additional use of the guide by the instructor.

Any one using the text referred to will find this an admirable guide for its illustration by map and exercise. It contains many suggestive questions that must help the inexperienced teacher toward modern points of view. This is particularly true of the questions on map reading, which are good and abundant, as they ought to be. For class use they may need some selection apart from selection of exercises, if thorough work by the student himself is to be done. Thus the exercise numbered 13, contoured maps, has material for three one hour exercises with pupils in the 'early stages of the high-school course,' if the reviewer's experience is to be trusted. Drawing a section for the first time, for instance, is no side issue, but quite a task in itself. Alongside this exercise 263b, C. S. Chart No. 3,089 is wonderfully short and easy, though for students well advanced toward the end of their course. The practical exercises are still further from definite form. It would be a hardship to put this book into the hands of the ordinary teacher of the subject, who is almost invariably too crowded for time and too incompetent in the subject matter to rearrange the exercises in practical form, and require her to use it with her classes. No doubt the class would get advantage of it.

It might be supposed that the wide use of laboratory manuals for physics and chemistry might guide us in some measure in preparing one for physical geography. Many of these are models in their clear statement of what materials to use, what to do with them and how to do it. This definiteness is of great importance. First-year pupils in a high school will find the latitude exercise in this volume, with its generalities, its principle, its geometry and trigonometry, very discouraging.

The description of field exercises for use in unknown localities has generality and vagueness imposed on it by necessity. It is difficult to conceive of satisfactory accounts being written for such work. Professor Brigham has gathered together some excellent suggestions, and that is all that can be done. The variety of the local fields forbids adequate general treatment. The point of view of the work is modern and scientific, as would be expected of its author. Teachers will find it a safe guide to open their eyes and those of their pupils to the real world about them. Altogether we are left still awaiting an adequate laboratory manual for physical geography, but in the present volume is much material that ought to figure in the book when it is written, much material that ought to be in the hands of teachers attempting laboratory work or wishing to know how to do it.

Mark S. W. Jefferson.

Ypsilanti, Mich.,
September 19, 1905.

Elements of Applied Microscopy. A Textbook for Beginners. By Charles-Edward Amory Winslow, Instructor in Industrial Microscopy and Sanitary Biology in the Massachusetts Institute of Technology. Pp. 183, with 60 text figures. New York, John Wiley and Sons. 1905.

This manual is an excellent example of a book prepared for a definite purpose and as the result of experience in an institution where independent work and special ideas have a prominent place.

As the author states in his preface the book does not profess to compete, on the one hand, with monographs or on the other with the popular works on microscopy. It is, however, specifically intended for the class in industrial

microscopy for second year students in chemistry and biology at the Massachusetts Institute of Technology. The object of the course is to give facility in the manipulation of the microscope and an acquaintance with the scope of its practical application.

The first four chapters consider the microscope and its accessories, and the other eight chapters deal with the starches, adulterations of food and drugs, textile fibers, paper, medicine and sanitation, forensic microscopy, microchemistry, petrology and metallurgy.

Each subject is dealt with in a general manner to give the student the principles and the point of view. Exercises are then given to illustrate the methods necessary for the elucidation of the questions which arise in actual practise.

The book is well conceived and satisfactorily worked out. The statements are usually clear and concise. As planned by the author, it is an introduction to the subject, and was designed for use by a teacher possessing knowledge of the more elaborate books, and the monographs bearing upon the various subjects. For the student, excellent references to good sources for further information are given with each chapter so that those especially interested can follow out the subject.

It is not particularly adapted for private learners, as the directions are frequently too brief without the supplementary instruction which naturally goes with a laboratory course. Two directions would prove unsatisfactory in practise: On page 41 the student is told to transfer cover-glasses from the potassium dichromate, sulfuric acid cleaning mixture to fifty per cent. alcohol. *After a thorough rinsing in clean water,* should have been added. On page 28 under the directions for using the Abbe condenser, it is said: 'In general an opening [of the diaphragm] about the size of the front lens of the objective will yield good results.' While this applies to lighting, when no condenser is used it would lead one to light with a less aperture when using an oil immersion objective than when using a low power dry objective. It contravenes the principles given in the preceding chapter. These and a few other slips will be easily remedied by the teacher and will be naturally righted in a new edition.

It is a source for congratulation that books of this kind are originating from the laboratories of our country, and it is hoped that the number will increase. S. H. G.

The Structure and Development of Mosses and Ferns (Archegoniates). By DOUGLAS HOUGHTON CAMPBELL, Ph.D., Professor of Botany in the Leland Stanford Junior University. New York, The Macmillan Company; London, Macmillan & Co., Ltd. 1905. All rights reserved. Pp. vii + 657. 8vo.

It is but a little more than ten years since the first edition of this book appeared, and now we have a second and considerably revised edition, in which much new matter has been added. By an odd oversight, the fact that this is a second edition is not indicated on the title page, although it is clearly stated in the 'Preface to the Second Edition' with which the volume opens. In this revision, the whole book has been printed from new type, none of the old stereotype plates having been used. This has given the author as much freedom in the preparation of the present book as though it were wholly new, and he has not been obliged to confine his changes to such as could be made to conform to the limitations of the old plates. The result is that this is a new book, and while it resembles the earlier one, and contains much matter which was in that edition, there is scarcely a page or paragraph in which the author has not made some changes of greater or less importance.

The new book follows the same general sequence as the old one, and, on a cursory glance, the reader sees little difference, yet a closer examination shows many changes and additions. The more important changes are those in the treatment of *Marattiales, Isoetaceae* and *Lycopodinae.* In the old edition, the *Isoetaceae* were discussed in connection with the *Marattiales,* to which they were regarded as related, but in the new book we find them taken up after the *Lycopodinae,* being regarded as 'sufficiently distinct to warrant the establishment of a separate order, *Isoetales.*'

Two wholly new chapters have been added, viz., the 'Nature of the Alternation of Generations,' and 'Fossil Archegoniates.' The whole number of pages in the earlier book is 544, while in the present volume it is 657. So, too, there are 266 figures in the old book, and 322 in the new. The amount of enlargement of the bibliography may be estimated from the fact that it covers 13 pages in the first edition, and more than 23 in the second.

In his closing chapter, the author presents a revision of the summary and conclusions of his earlier book. Briefly, he now holds that the archegoniate series began in the green Algae near *Coleochaete;* that the Liverworts are the most primitive of existing archegoniates, and that other groups have descended from them. The peculiar chromatophore of Anthocerotaceae possibly suggests the independent origin of this group, and this with other structural facts requires that they be accorded higher rank than heretofore, possibly that of a class coordinate with 'Liverworts on the one hand and the Mosses on the other.' Pteridophytes still consist of three classes, all evidently related to the Anthocerotes, but representing entirely different lines of development. The eusporangiate ferns are regarded as the lowest of the *Filicinae;* Hymenophyllaceae, while of pretty ancient origin, are regarded as an aberrant group; and the *Polypodiaceae* constitute the modern fern type. "That heterospory arose in a number of widely remote groups is unquestionable." This suggests the possibility of a multiple origin of the spermatophytes. "Except for their siphonogamic fertilization, Gymnosperms are much nearer the Pteridophytes than they are to the Angiosperms." "The close resemblance between the Conifers and the Lycopods, especially *Selaginella,* probably points to a real relationship." Cycads are regarded as descended from fern-like ancestors. While the position of *Isoetales* is still in doubt, it is regarded as possible that the Angiosperms may have arisen from them.

This edition without question must prove to be as helpful and suggestive as the one it supplants, and will be used by all students who wish to obtain a clear notion of the structure and relationship of higher plants.

Charles E. Bessey.
The University of Nebraska.

SCIENTIFIC JOURNALS AND ARTICLES.

The first article in the September number of the *American Geologist*—'Pleistocene Features in the Syracuse [N. Y.] Region,' by Professor H. L. Fairchild—was prepared for the field program of the meeting of Section E of the American Association for the Advancement of Science at Syracuse last summer and is illustrated by two plates. Professor Charles S. Prosser contributes a paper entitled 'Notes on the Permian Formations of Kansas.' The recent investigations concerning the age of the upper Paleozoic formations of Kansas are reviewed and it is shown that the European and American geologists who have studied the subject most carefully in recent years correlate them with the Permian. 'The Atlantic Highlands Section of the New Jersey Cretacic' is described by Mr. J. K. Prather and is illustrated by three plates. Professor William H. Hobbs publishes 'Contributions from the Mineralogical Laboratory of the University of Wisconsin.' It consists of a description of minerals from various localities, illustrated by one plate of metallic copper from Soudan, Minn., and figures of other minerals.

The leading article in the September-October number of the *Journal of Geology* is by Professor Rollin D. Salisbury on 'The Mineral Matter of the Sea, with some Speculations as to the Changes which have been involved in its Production.' Dr. Reginald A. Daly contributes a paper on 'The Classification of Igneous Intrusive Bodies,' which is illustrated by nine figures. Mr. J. K. Prather describes 'Glauconite' from the (Cretaceous) Greensands of New Jersey and gives a plate of photomicrographs. 'The Mesozoic of Southwestern Oregon' is described by Mr. George D. Louderback. The rocks are called the Myrtle group or series and the Dillard series. Their lithologic characters, economic relations and areal distribution are well de-

scribed and an interesting comparison is made with 'the standard California type formations.' The concluding paper, the 'Arapahoe Glacier in 1905,' is by Professor Junius Henderson.

The American Naturalist for October contains articles on 'A Peculiar Variation of *Terebratalia transversa* Sowerby,' by H. W. Shimer; 'Studies on the Plant Cell, VIII.,' by Bradley M. Davis; and '*Diadasia* Patton; a Genus of Bees,' by T. D. A. Cockerell. The article on the plant cell is the final one of the series and it is noted that the author has a number of complete sets of reprints, and that enquiries concerning them may be addressed to him at the University of Chicago. Professor Cockerell's article includes a table for the identification of all the species of the genus.

The Museums Journal of Great Britain for October has for its leader an article on 'Local Museums,' by J. Willis Bund, one of several papers dealing with this subject that were read at the last meeting of the Museums Association. The matter is one that should be specially commended to the attention of our schools and colleges, local museums being all too rare in the United States, where much time and effort is thrown away in the attempt to make a small museum cover the universe instead of devoting its energies to the immediate locality. Among the notes American readers will blush to find the prominence given to some comparatively recent occurrences at the Metropolitan Museum of Art.

THE closing (October) number of volume 6 of the *Transactions of the American Mathematical Society* contains the following papers:

MAURICE FRÉCHET: 'Sur l'écart de deux courbes et sur les courbes limites.'

JOHN EIESLAND: 'On a certain system of conjugate lines on a surface connected with Euler's transformation.'

L. P. EISENHART: 'Surfaces of constant curvature and their transformations.'

N. J. LENNES: 'Volumes and areas.'

E. O. LOVETT: 'On a problem including that of several bodies and admitting of an additional integral.'

F. R. SHARPE: 'On the stability of the motion of a viscous liquid.'

A. LOEWY: 'Ueber die vollständig reduciblen Gruppen, die zu einer Gruppe linearer homogener Substitutionen gehören.'

W. B. CARVER: 'On the Cayley-Veronese class of configurations.'

This number also contains: Notes and Errata, volumes 5, 6; Table of Contents, volume 6.

SOCIETIES AND ACADEMIES.

THE PHILOSOPHICAL SOCIETY OF WASHINGTON.

THE 604th regular meeting was held October 7, 1905, with President Littlehales in the chair.

The evening was devoted to a paper by Professor W. D. Miller, of the University of Berlin, on 'Symbiosis.' He defined symbiosis as a life relationship existing between different kinds of animals or plants, or between animals *and* plants. The relation of the mistletoe to the tree on which it grows, for instance, is a symbiosis. According as advantage or disadvantage accrues to one or the other or to both of the parties concerned the symbiosis is designated as parasitism, commensalism and true or mutualistic symbiotism.

By parasitism we designate that type of symbiosis in which one individual lives at the expense of the other, doing it some harm without making any return; the first being called the parasite, the latter the host. Such is the relation of fleas, lice, bugs, tapeworms, etc., to the human being. By far the most important of this type is that existing between bacteria and the human subject.

By commensalism (*con, mensa*) we designate a symbiosis in which the one party lives from the superabundance or from the crumbs of the table of the other, deriving thereby a benefit from the relationship, but doing no harm and also making no return. In true symbiosis *both parties* derive an advantage from the relationship. Such is the symbiosis between the hermit crab and the sea anemone, between ants and plant lice, etc.

Especial attention was called to the tripartite symbiosis existing between animals, higher plants and bacteria, all animals being dependent upon plants for their food, the higher

plants upon bacteria for keeping up the store of carbon dioxide and of combined nitrogen necessary for plant life, and bacteria dependent upon animal or vegetable matter for their nourishment. The very important and beneficent rôle here played by bacteria in the household of nature has led to the view that they also hold a similar relation to the human body directly, and that the myriads of bacteria found in the alimentary canal not only serve as aids to digestion, but are absolutely essential to this process.

This view was placed upon a scientific basis by Schottelius, who sterilized hens' eggs, hatched them in sterilized incubators and fed them on sterilized food to find that they ate voraciously, but instead of increasing in weight, gradually grew thinner and died in the second or third week. If, however, hen manure was added to the food before the chicks had succumbed, they soon revived and developed rapidly and normally. This experiment proves that bacteria as a matter of fact are necessary to digestion in the case of chicks. It does not follow, however, that the same is true of human beings or of mammalia in general. Thierfelder and Nuttall found that guinea-pigs, taken aseptically from the mother and fed aseptically, developed perfectly normally; this experiment was carried on, however, but for a few days.

There are many other reasons for doubting the usefulness of bacteria as aids to digestion in the human being:

1. The ferments of the alimentary juices ptyalin, pepsin, trypsin, pancreatin, etc.) are capable of carrying on digestion without the aid of bacteria.

2. Digestion by bacteria in the stomach is impossible under normal conditions, on account of the acid reaction of its contents.

3. It is a question whether the bacteria of the intestines, being bathed in foodstuffs already digested do not in a great measure lose the power of peptonizing albuminous substances just as nitrogen-fixing bacteria cultivated on media rich in nitrogen lose the power of fixing nitrogen from the air.

4. By far the great majority of bacteria are found in the large intestines, whereas the digestion and absorption of food take place almost solely in the small intestines. Metchnikoff emphasizes this point in particular and maintains that the large intestines are not only useless, but positively harmful, and even suggests the idea of removing them surgically.

5. Digestion by bacteria is accompanied by the production of substances which are poisonous to the animal body and, for instance, eggs, meat, fish, oysters, etc., undergoing bacteritic digestion (putrefaction) are absolutely unfit for use and in some cases violently poisonous. This fact tallies also with practical experience, which teaches us that wherever bacteria obtain the upper hand and the normal process of digestion is replaced by bacteritic action, either in the stomach or intestines, serious disturbances in the shape of 'spoiled stomach,' headache, nausea, vomiting, diarrhœa, etc., take place.

In the mouth most of the bacteria convert the carbohydrates into lactic and other acids which decalcify the enamel and dentine, so causing decay of the teeth and all its accompanying evils, and we have no evidence whatever that the physiological action of the saliva is furthered by them, in a corresponding degree.

Bacteria are consequently not only not essential to digestion, but they produce serious disturbances in the mouth, stomach and intestines wherever they multiply in excessive numbers. They should consequently be kept down by every means at our disposition and especially as to the mouth; a thorough cleansing of the teeth after every meal not only goes far to keep the teeth and gums in a healthy condition, but contributes much to the general health.

There are, however, in the various cavities of the human body communicating with the outer world (mouth, intestines, vagina) certain bacteria which constitute the peculiar floræ of these cavities and which serve a beneficial purpose by their antagonism to other bacteria.

Some thirty lantern views illustrated the general subject and the speaker's own researches on the bacteria of the mouth; there were several beautifully stained sections of

teeth and microphotographs of other sections showing the infiltration of the dentine with bacteria.

The paper was discussed by Dr. Wiley from the chemical standpoint and by Dr. Kober with reference to the question of soils.

A vote of thanks was tendered the speaker for his very interesting and important paper.

CHARLES K. WEAD,
Secretary.

THE SOCIETY FOR EXPERIMENTAL BIOLOGY AND MEDICINE.

THE thirteenth meeting of the Society for Experimental Biology and Medicine was held in the Physiological Laboratory of Columbia University, at the College of Physicians and Surgeons, on Wednesday evening, October 18. The president, Edmund B. Wilson, was in the chair.

Members present.—Adler, Auer, Brooks, Burton-Opitz, Calkins, Dunham, Emererson, Ewing, Field, Gies, Hiss, Jackson,[1] Lee, Levene, Levin, Lusk, Meltzer, Meyer, Murlin, Noguchi, Norris, Park, Richards, Salant, Sherman, Sweet, Torrey, Wadsworth, Wilson, Wolf, Woodworth, Yatsu.

Members elected.—Carl L. Alsberg, S. P. Beebe, R. H. Chittenden, P. M. Dawson, W. J. Elser, G. M. Meyer, P. A. Shaffer, Douglas Symmers, L. L. Woodruff.

Abstracts of Reports of Original Investigations.[2]

A Fatigue Wheel. FREDERIC S. LEE.

The author exhibited a wheel designed for fatiguing mammals by means of voluntary muscular work.

Mutation in the Evening Primrose, Onagra biennis (L.) Scop., with demonstrations. ELIZABETH BILLINGS and FREDERIC S. LEE.

Culture experiments by the authors confirmed MacDougal's discovery of a narrow-leaved mutant of this species. It is possible that a second mutant was found, but further observations are needed to confirm this.

Influence of Thyroid Feeding, and of Various Foods and of Small Amounts of Food upon Poisoning by Acetonitril. REID HUNT. (Presented by Alfred N. Richards.)

The experiments were performed on mice. *Resistance* to the action of acetonitril was *increased* by administration of thyroid or potassium iodid, or by feeding a carbohydrate diet or a 'limited diet.' Resistance to the action of hydrocyanic acid was *not increased* by administration of thyroid or by feeding a 'limited diet.' Resistance to sodium nitroprussid was *not increased* by administration of thyroid.

Susceptibility to the action of acetonitril was *increased* by administration of thyroidectin and parathyroid and by feeding a protein diet.

A Case of Spirochætal Infection in Man, with demonstrations. CHARLES NORRIS.

The author described the first case reported in this country of spirochætal infection verified by microscopical examination of the blood. In July of this year the patient shipped as an assistant steward on the S. S. *Denver,* of the Mallory Line. He stayed five days in Galveston, slept on board and returned on the same steamer to New York. The spirochæte of this case, as seen in the blood of inoculated monkeys, as well as in the human blood, was similar to the spirochæte refringens.

The case directs attention to the probability of mild spirochætal infections, more or less constantly occurring, in sailors or travelers coming from southern parts into New York. The author also called attention to the possibility that spirochætal infection may be communicated, from person to person, through the bites of ticks and bed-bugs, and through wounds.

The Chromosomes in Relation to the Determination of Sex in Insects. EDMUND B. WILSON.

Two types of differences between the chromosome-groups of the two sexes occur in the Hemiptera. In one type the females have one

[1] Non-resident.

[2] The abstracts presented in this account of the proceedings have been greatly condensed from abstracts given to the secretary by the authors themselves. The latter abstracts of the communications may be found in current numbers of *American Medicine* and *Medical News.*

more chromosome than the male (*Anasa, Alydus, Protenor*); in the other type both sexes have the same number of chromosomes, but differ in respect to a particular chromosome (the 'idiochromosome'), which is smaller in the males than in the females (*Lygæus, Euschistus, Cœnus, Podisus*). The relations show that these differences must be determined at the time of fertilization, and they arise from the fact that two classes of spermatozoa exist in equal number. In the first type one half of the spermatozoa possess one more chromosome than the other half. In the second type half the spermatozoa possess a large idiochromosome and half a small one. Females are produced in each case upon fertilization by spermatozoa of the first class, males upon fertilization by spermatozoa of the second class.[3]

Experimental Hepatic Cirrhosis in Dogs from Repeated Inhalations of Chloroform. C. A. Herter and William R. Williams.

Repeated chloroform inhalations caused, in dogs, an abundant, richly cellular connective tissue growth between and into the hepatic lobules. The bile ducts were proliferated and the liver cells showed much fatty and hyaline degeneration. The percentage of arginin obtainable from the proteids of the hepatic tissue was less after the chloroform treatment than that obtainable from the normal tissue. The proportion of fat in the liver cells was also reduced.

These observations open the question whether the fatty and parenchymatous degenerations of the liver, which in some cases follow narcosis by chloroform in the human subject, may not occasionally pass on to interstitial cirrhosis—a single narcosis in man being sufficient to induce the primary damage to the protoplasm of the liver cell.

Color Sense in Different Races of Mankind. R. S. Woodworth.

The author endeavored to ascertain whether races of mankind which seem to represent the more primitive stages in human development are specially subject to color blindness. The experiments were carried out in association with Mr. Frank G. Bruner, under the Anthropological Department of the St. Louis Exposition. Of 252 adult male Filipinos (including Christians and Moros), 14, or 5.6 per cent., were red-green blind. Of 75 males of the 'wild tribes' of the Philippines (Igorots, Tinguianes and Bagobos), 2, or 2.7 per cent., were red-green blind. Of 13 male Negritos, none was color blind. A negative conclusion is warranted as to the suggestion that the color sense has developed, within human history, from anything approaching red-green blindness. Various additional results also opposed the view that the color sense has developed within human history from a more primitive type in which only the red end of the spectrum appeared as colored.

On the Practical Concentration of Diphtheria Antitoxin. R. B. Gibson.

The author described a new method for the preparation of concentrated diphtheria antitoxin. The serum is precipitated with an equal volume of saturated ammonium sulfate solution, and the precipitate extracted with a solution of saturated commercial sodium chlorid. The antitoxin globulin dissolves in the latter and the insoluble globulin is separated by filtration. The antitoxin is separated from the filtrate by addition of a half-volume of saturated ammonium sulfate solution, or better still, by addition of acetic acid in the usual way. The precipitate separated by filtration is pressed as dry as possible between absorbent paper and dialyzed a few hours in parchment paper. The resultant dialyzed solution is then neutralized and redialyzed for several days. A quarter of a per cent. of sodium chlorid and some toluol are added and sterilization effected by double filtration through a Berkfeldt filter.

The concentrated antitoxin solution thus prepared contains probably from two to three times the proportion of protein present in normal serum. Large quantities of serum can easily be worked over at comparatively small expense by the method indicated and the product thus prepared is as good or better than ordinary antitoxic serum, in practically all respects.

[3] Science, 1905, XXII., p. 500.

On the Effect of Magnesium Salts upon the Excitability and Conductivity of Nerves. S. J. MELTZER and JOHN AUER.

Numerous applications of solutions of magnesium salts to the sciatic, pneumogastric, depressor and sympathetic nerves of rabbits failed to produce any evidence of excitation, but in each case there resulted sooner or later a profound inhibitory effect upon the conductivity of the nerve under observation. Thus, after application to the sciatic nerve, the conduction of motor and sensory impulses was manifestly inhibited: a strong stimulus applied below the 'block' caused strong contractions of the muscles of the thigh but no pain; when applied above the 'block,' stimulation induced pain but failed to cause contraction. Such effects were obtained with hypertonic as well as with isotonic and even with strongly hypotonic solutions. The weaker the solution the longer it took to establish complete interruption of conductivity. Conductivity could be restored by washing the nerve with Ringer's solution.

WILLIAM J. GIES,
Secretary.

DISCUSSION AND CORRESPONDENCE.

THE GEOGRAPHICAL DISTRIBUTION OF STUDENTS.

TO THE EDITOR OF SCIENCE: In Dr. Tombo's interesting article on 'The Geographical Distribution of the Student Body at a Number of American Universities' which appeared in SCIENCE for October 6, 1905, he was careful to state that 'in the case of Harvard University the students of Radcliffe College (undergraduate women) are not included.' May I amend that statement by saying that only men were counted in the Harvard table, the graduate students as well as the undergraduate students of Radcliffe College having been excluded. Had these 407 students been included, several comparative statements in the article would have been affected. Harvard would have led in the North Atlantic division by 47, and would have gone from fourth place to third place in the South Atlantic division. In the line of grand totals Harvard would have led by 361, Columbia being second and Michigan third. Had women been wholly omitted or separately counted in Dr. Tombo's table, several rearrangements would obviously have been necessary.

JEROME D. GREENE.

HARVARD UNIVERSITY.

THE MAKING OF LANTERN SLIDES.

TO THE EDITOR OF SCIENCE: Every one knows how troublesome it is, in the making of lantern slides from a variety of objects, to accurately center the images on the negative plates; how very troublesome it is to get a centered lantern slide from an eccentric negative, and how much time is required in cutting paper mats for bounding the field of a lantern slide. For several years I have employed a method which I find obviates these difficulties almost completely.

In making my negatives I take pains to get the desired size of image, but do not take the trouble to center the image upon the spot where the negative plate is expected (?) to be.

I take these negatives and trim them by means of a cutting diamond to the size of the transparent square desired on the lantern slide. I can trim thirty negatives in fifteen minutes.

I then take my lantern plates, lay them film side up on a black ground, lay a trimmed negative centrally on each, and print by a light held above.

The resulting positives are perfectly centered, and the desired field is sharply bounded by a nearly opaque border which is as satisfactory as a carefully cut paper mat.

W. S. FRANKLIN.

SPECIAL ARTICLES.

ORTHOGENETIC VARIATION.

SINCE I am responsible for the term 'orthogenetic variation,' whilst the far greater idea of 'orthogeny' falls to the credit of the late Theodor Eimer, I am anxious that it should not be misrepresented.

The paper by Mr. Robert E. Coker, entitled 'Gadow's Hypothesis of Orthogenetic Variation in *Chelonia*,' Johns Hopkins University Circular No. 178, May, 1905, calls for some remarks on my part by way of protest and

correction. In my paper[1] I concluded as follows, concerning the observed variations in the number and arrangement of the scutes of the loggerhead, *Thalassochelys caretta:*

These variations from the normal type all lie in the direct line of descent, and the more serious the variation, the further back it points. Moreover the changes necessary to turn any given variation into another one less abnormal until ultimately the normal condition is reached, are not erratic, but stand in strict correlation with each other and proceed strictly on definite lines. I, therefore, call this kind of atavistic variation orthogenetic.

Further, I had suggested that the individual, abnormal turtles 'grow out of these irregularities by the reduction or squeezing out of certain of the scutes,' and I concluded as follows:

Of course there is no proof of what I have tried to explain. Comparative anatomy and common sense tell us it is so. But common sense is not evidence in a sceptical court. The only way of proving the correctness of the view explained in this paper would be to take a number of abnormal turtlets and to watch, while they are growing up, if and how they mend their irregular shells and become normal.

I think I had stated the case fairly. It left no doubt about the definition of at least one kind of orthogenetic variation. Of course, it can not be expected that a turtlet with, say, twenty-four dorsal scutes can, during its growth, reduce them to the normal number of sixteen. I had said as much. Many a turtlet probably sticks fast during the mending process. Otherwise there could be no abnormal adult specimens, if my surmise is correct. But if they do amend the number of scutes, these cases of orthogenetic variation are simply ontogenetic stages, passing reminiscences of earlier, phylogenetic conditions. We ourselves begin with an embryonic tail of numerous metameres, and their ultimate reduction to five, four, three or two free caudal vertebræ falls under the same category of variation.

Orthogenetic variation implies something progressive, no matter whether it means increase or decrease in numbers. A case of increasing tendency is, for instance, the striation of certain species of the lizard genus *Cnemidophorus,* of which the small *C. deppei* varies in the possession of seven to eleven white stripes, the eleven-striped individuals and the six-striped *C. sexlineatus* representing the two extremes. A study of these lizards has convinced me that in many cases a limited increase in the number of stripes takes place during individual growth. For detail I must be permitted to refer to my paper.[2]

Mr. Coker does not believe that orthogenetic variation (or, as he says, 'determinate') exists in the *individual* turtle. He holds that my assumption can not be proved by percentages. Whilst I rejected the notion that the irregular number of scutes has any serious influence upon the successful life of the turtles, he thinks it is quite conceivable. But 'at least the more extreme cases may be but one of the evidences of a congenital weakness,' so 'that a greater proportion of abnormal than of normal turtles fail in the struggle.' Of course, this may be the case. But how are we to find it out, unless we watch a number of them growing up? The fact remains that there are adults with very abnormal scutes which do very well. Mr. Coker is indignant at my saying that no less than fourteen per cent. of large turtles were wrong, when I had only one such abnormal specimen out of seven large specimens. I grant that this was the wrong way of putting the case. Let me, therefore, mend the sentence as follows:

No less than twenty-two per cent. of turtles of the considerable size of two feet and upwards, are wrong in their scutes, and do, or did very well, for all we know to the contrary.

On the other hand, he found that of 28 embryos of *T. caretta,* of one nest, only 9 had more than the normal number of 16 scutes, with totals of 17, 18, 19 and 20; whilst two had each one costal too few, making a total of

[1] 'Orthogenetic Variation in the Shells of *Chelonia*,' Willey's *Zoological Results*, Pt. III., May, 1899, pp. 207–222, pls. XXIV.–XXV.

[2] 'Evolution of the Colour-pattern and Orthogenetic Variation in Certain Mexican Species of Lizards with Adaptation to their Surroundings,' *Proc. Roy. Soc. London,* Vol. 72, May, 1903, pp. 109–125, pls. 3–5.

15 costals and neurals. These two specimens are really very interesting, since they fill the gap in my table, between totals of 16 and 14. This reduction is due to the falling out of a pair of costals, as is shown by comparison of *Thalassochelys* with *Chelone*. This shortage of one costal scute in Coker's turtlets is, however, not 'precocious,' since 16 is the normal number in this species, but it is rather prophetic so far as Cheloniidæ are concerned. Therefore, no need for him to say that it would be difficult to explain this deficiency as precocity. But I am at a loss to understand what bearing his table on page 20 has upon my hypothesis, considering that all his turtlets were embryos, most of them still unripe. I trust that he does not impute to me the belief that the turtlets should begin to mend their ways before they are born.

The fact remains that, with the addition of Coker's turtlets to the 76 specimens enumerated in my table, the percentage of specimens with supernumerary scutes still decreases steadily with age. Of course, such calculations are always precarious unless they are based upon very great numbers, and it is not unlikely that the amount of variation in the members of one brood differs much according to clans, or regions, not to mention the parents about whom we know nothing.

	Per cent.
Of 73 embryos or new born, 53 are abnormal	=7
Of 9 specimens from 3 to 8 inches incl., 3 abnormal	=33
Of 19 specimens from 8 to 24 inches incl., 5 abnormal	=22
Of 9 specimens from 24 inches to "large," 2 abnormal	=24
Of 7 large specimens, only 1 abnormal	=12

Still more surprising are Mr. Coker's conclusions as drawn from the examination of 250 specimens of the diamond-back terrapin, *Malacoclemmys centrata* Latr. Examination of 250 individuals of all ages and sizes in the condition just as they were caught. He found, however, a few cases which indicate that partial fusion, or division, of neighboring scutes has been going on during the creature's life. The occurrence of reduction by fusion, of increase by division during the individual's growth is, therefore, demonstrated. Would it not go a long way in support of my hypothesis if actual observation showed that the total number can be reduced during life by one single scute? I ought to feel grateful for such a help, willing to waive the experimental proof, and be glad to accept fusion instead of my suggested squeezing out. Lastly, I ought to feel crushed by Mr. Coker's table, which shows, if anything at all, that in the diamond-back the scutes seem to increase instead of decreasing with age. The author himself is confirmed in the 'belief that in *Malacoclemmys* we do not have orthogenetic variation in the sense that there is normally in the individual life history a progressive reduction in the number of scutes.'

No, of course not. The whole investigation has ended in a farce. A beast which frequently goes in for the longitudinal splitting of its true neural scutes is not a fit subject for the study of orthogenetic variation. This is malformation pure and simple; it is as little atavistic, or in line with anything, as are six fingers in man, or five toes in fowls.

I do not profess to know what the diamond-backs are after. Perhaps this crazy splitting may in time establish a new type of chelonian with a completely double series of neural scutes! However, Coker himself did not fail to see that in these creatures 'the tendency is not toward, but away from the type.' He should, therefore, have ruled them out of court. But there surely is also a *beyond the type,* and this seems to have puzzled him sorely, as is shown by his footnote 3 on page 18 of his paper. For instance, if (whether congenital, or due to fusion, division or suppression) a loggerhead or other marine turtle has only five neurals, that would be something beyond the type of Cheloniidæ, and in this respect very abnormal, but still orthogenetic, since reduction to five neurals has been realized and has become the normal condition in *Pleurodires* and even in certain species of *Testudo*. Such a case in a marine turtle would be, so to speak, prophetic, and quite reasonable, and a trained morphologist would recognize that such things are 'quite in the line' of tortoises.

My appeal to comparative anatomy and common sense has been of little avail. I venture to make a practical suggestion. The eastern states are the home of many kinds of

chelonians. Ponds, creeks, marshes and rivers are swarming with them, and surely a place could be found which only requires fencing to be turned into a scientific, experimental 'crawl,' where some hundreds of turtles of a suitable kind could be turned loose, labeled, of course, and examined from time to time whether any of them are amending their abnormal shells. For physical reasons such an experiment of possibly far-reaching, fundamental importance, can not be made in Europe.

H. Gadow.

Cambridge, Eng.,
September 4, 1905.

Note on Vector Symbols.

The question of notation was always of importance, and the introduction of new methods depends a good deal on it. It is, of course, highly desirable to have *one* system of notation used by all the scientific world, but at the same time it is also desirable that the system in use shall be a simple and easy one.

The vector-analysis becomes more important every day in the study of physics. It is, therefore, necessary to have a vector notation as simple as possible. The notation used today is far from being uniform, and still the tendency is towards the introduction of German letters for the symbolization of vectors. May be that when printed, the German letters look well, and are well distinguished from the Latin alphabet. The student, no matter of what nationality, can learn to recognize them just as he learns to recognize the Greek alphabet. But the question is the *writing* of the German characters. Those that try to picture a German print-letter on the board when necessary to use the vector symbols in a lecture before a class will know how difficult this is. And to use different signs when written and different signs when printed does not seem reasonable. Why not use as symbols for vector quantities the Latin alphabet? The Latin alphabet is almost universal, and there is no difficulty whatever to write this alphabet. I, therefore, propose—with Professor Karl Heun in Germany—to use the following notation for vectors, a notation as simple as it can be.

All vector quantities are written as follows: $\bar{a}$, $\bar{b}$, $\bar{d}$, $\cdots$, $\bar{A}$, $\bar{B}$, $\bar{G}$, $\cdots$, and their tensors respectively: $a, b, d, \cdots, A, B, G, \cdots$. The scalar-product of two vectors $\bar{a}$ and b is written: $\bar{a}\bar{b}$, which, by definition, is $= a\,b \cos(a, \bar{b})$. The vector-product of two vectors $\bar{a}$, $\bar{b}$ is written thus: $\overline{ab}$, and because it is itself a vector it can be written: $c = \overline{ab}$. The tensor of this vector: $c = ab \sin(\bar{a}, \bar{b})$. The unit vector can be written, for instance, $\bar{a}_1, \bar{b}_1, \cdots$, so that $\bar{a} = a\,\bar{a}_1$, $\bar{e} = e\,\bar{e}_1$, $\cdots$.

The advantage and simplicity of this system of notation speak for themselves.

H. Schapper.

University of Arkansas,
Fayetteville, Ark.,
August 8, 1905.

The Occurrence of Ichthyosaur-like Remains in the Upper Cretaceous of Wyoming.

Through the kindness of Professor S. W. Williston, I have recently received two fragmentary vertebræ found by Mr. W. H. Reed in the Benton Cretaceous near the north end of Medicine Bow Mountains. Although very fragmentary, these vertebræ appear to represent a genus allied to *Ichthyosaurus*. As this reptilian group has not been known in North America in beds as late as the Benton, the discovery is of considerable interest.

The larger fragment consists of the upper three fourths of a deeply biconcave vertebral centrum apparently from the cervical or anterior dorsal region. The centrum is very thin antero-posteriorly, and in this respect somewhat resembles the corresponding centra in *Baptanodon discus*. The sides are considerably damaged, so that it is not possible to make a definite statement concerning the rib articulation, but it seems to have been double, as in *Baptanodon*. A foramen close to the upper end of the diapophyses is larger than any I have seen in this position in the typical Ichthyosaurs, and adds somewhat to the difficulty of making a definite determination of the relationships of this form.

When more material is available it will be interesting to learn whether this form really represents a true *Ichthyosaurus* or possibly a more highly specialized form of *Baptanodon*

than those which we know from the Baptanodon beds. Should it be *Baptanodon,* it will probably show some extreme specializations, as the time separating the Benton from the Baptanodon beds is considerable.

JOHN C. MERRIAM.

QUOTATIONS.

TRUSTEES AND FACULTIES.

THE *Review* is greatly interested to learn that a national congress of the trustees of American universities is to be held this month at the University of Illinois in connection with the inauguration of its new president, and that this conference will be devoted to a discussion of the best form of administration of higher educational institutions and of the proper share of trustees, faculty and alumni in their government. Such a discussion is of especial interest at this time to institute men because of the unfortunate divergence in opinion of the corporation and faculty as to the future educational policy of the institute, and because of the absence of any intermediate body or other means of conference by which an intimate exchange of opinions might take place, and the differences in point of view of the two bodies might be reconciled or compromised.

Whatever be desirable from an ideal standpoint, the practical conditions surrounding American education, especially the legal requirements and the constant need of renewed financial support, will undoubtedly make necessary the existence of a board of trustees in our educational institutions. The proper relations of such a board to the faculty and alumni is a large question, and one which must receive a somewhat different answer in different institutions. The *Review* believes, however, that the following general principles are vital to the soundness of our educational system. The board of trustees and the faculty must be coordinate bodies, the latter being in no sense subordinate to the former. There must be as sharp a division of functions as is practicable, the trustees dealing exclusively and finally with legal and financial questions, and with the appointments of president and faculty, and the faculty having exclusive jurisdiction in purely educational questions, including not merely the details of instruction, administration and student government, but all matters relating to curriculum, courses of study offered and degree requirements. General questions as to educational aims, and all the numerous questions involving both financial and educational considerations should be discussed by both bodies, and should be acted upon only after substantial agreement has been reached. And to this end there must be established conditions of harmonious cooperation and frequent opportunities for intimate contact and exchange of views. This would seem to be best obtained by the formation of an advisory council—consisting of five or six members from each body, with the president as chairman—which, after thorough discussion should make recommendations both to the trustees and to the faculty. Finally, the alumni not only should be urged to participate in the conduct of the social and athletic life of the students, and to recommend improvements in the courses of study, but they should also be given some direct and substantial share in the government of the institution.—*The Technology Review.*

THE RHODES SCHOLARSHIPS.[1]

THE opening of the present term at Oxford will add 67 new scholars to the list of those in residence under the bequest of the late Cecil Rhodes. Allowing for the withdrawal of a few of the German scholars who find it more in accord with their University system at home to take only a two years' course instead of the three years to which the scholarship entitles them, there remain over from last year's students 79, so that for the academic year 1905–6 the whole number in residence will be slightly under 150. The full list is not, however, yet complete. In 1906, when scholars are elected only for the Colonies and Germany, there will be a further addition of more than 30. As several of the communities concerned have in the last two years failed to send forward a candidate qualified to enter Oxford,

[1] The London *Times.*

the whole number will be still further increased in later years when this deficiency has been repaired. The total number for whom permanent provision is made is about 190, and no doubt this *maximum* will be reached before many years have elapsed.

In the election of scholars the only qualifying test in scholarship fixed by the trustees is the Oxford Responsions standard. An exception to this rule has hitherto been made in the case of South Africa and one of two Australian colonies; but after this year the test will be everywhere applied, except in Germany, where the selection of scholars was assigned by Mr. Rhodes to the Emperor himself. In all other cases a local committee of selection, usually composed of educational experts and sometimes of a school or university faculty, completes the election from among the candidates who have passed the preliminary test; and these committees are directed to select on the basis suggested by Mr. Rhodes. They are free to apply for purposes of comparison any further educational or other test they think desirable beyond that exacted by the trustees.

For 1904 five states or territories of the American Union failed to qualify a candidate on the Responsions standard, while no fewer than ten failed in 1905. The states thus failing in 1905 were Alabama, Arizona, Arkansas, Montana, Nevada, North Dakota, Oregon, South Dakota, Utah and Wyoming, mostly, it will be observed, the newer western states. Among the colonies Rhodesia has had some difficulty in filling up its annual quota of three scholars, and one scholarship is vacant this year. The organization of secondary schools has barely begun there, and in the meantime Rhodesian boys studying in England, but whose parents are spending their lives in the colony, have been considered eligible. This condition will be modified with the advance of Rhodesian education. The only other colonial community which has yet failed to send a scholar is the northwestern territory of Canada, which furnished a successful candidate in 1904, but none who qualified in 1905. Fifteen American scholarships and two colonial scholarships are therefore vacant at the present time through lack of duly-qualified scholars. When scholarships have once lapsed through failure of this kind they are not filled up in the succeeding year, but only in the regular cycle of appointment, as any other method would be unfair to prospective candidates for any given year.

THE RESEARCH LABORATORY OF PHYSICAL CHEMISTRY OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

Several changes have taken place in the staff of the Research Laboratory of Physical Chemistry of the Massachusetts Institute of Technology. Professor W. D. Coolidge has accepted a position in the Technical Research Laboratory of the General Electric Company at Schenectady, where he will be closely associated with Dr. W. R. Whitney. To Professor Coolidge has been due in large measure the development of one of the most important lines of work in progress in the research laboratory of the institute—the investigation of the conductivity of aqueous solutions at high temperatures. This research will be continued not only by several investigators at the institute, but also by Professor Coolidge at Schenectady. Mr. Yogoro Kato, who has also been engaged on the conductivity investigation for two years, has accepted a position in the Technical High School of Tokio, where he will have charge of the work in electrochemistry. Dr. Wilhelm Böttger returns as Privatdocent to the University of Leipzig, at which he will conduct one of the laboratory courses in analytical chemistry. In place of these retiring members, the following new appointments to the research staff have been made: William C. Bray, B.A., Toronto '02, Ph.D., Leipzig '05; Guy W. Eastman, S.B., M.I.T. '04; Gilbert N. Lewis, Ph.D., Harvard; Edward W. Washburn, S.B., M.I.T., '05. Mr. Roy D. Mailey has been promoted to the position of research associate. Seven candidates for the degree of doctor of philosophy are now pursuing work in the laboratory. By them and by the regular research workers, the investigations mentioned a year ago in Science are all being continued, and one new line of work has been entered upon, namely, a study

of the hydration of salts in aqueous solutions. This subject, which constitutes one of the most important as well as one of the most difficult of the unsolved problems relating to solutions, is being attacked by two independent methods by Mr. Edward W. Washburn and Mr. Richard C. Tolman. A series of eight articles describing the researches made in the laboratory during the last two years is about to be submitted to the Carnegie Institution for publication. The research laboratory has been assisted on the financial side by a further grant of five hundred dollars from the trustees of the William E. Hale research fund, by a gift of two hundred dollars from Mr. Samuel Cabot and by one of three thousand dollars from one of the professors of the institute.

THE AMERICAN SOCIETY OF NATURALISTS AND AFFILIATED SOCIETIES.

THE American Society of Naturalists and affiliated societies will meet at the University of Michigan, Ann Arbor, in Convocation week. The Central Branch of the society will meet, but we understand that the Eastern Branch will hold no meeting this year. There will meet in conjunction with the American Society of Naturalists the American Zoological Society, the American Physiological Society, the American Association of Anatomists, the Society for Plant Morphology and Physiology and the American Society of Bacteriologists, the latter society having suspended its rules of meeting only in the eastern states.

THE American Psychological Association and the American Philosophical Association, which have in recent years met with the Naturalists, will meet this year at Harvard University. On this occasion Emerson Hall, the new building for philosophy and psychology, will be formally opened.

THE NEW ORLEANS MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THE people of New Orleans have organized local committees to take charge of the arrangements for the meeting of the association, which will be held from December 29 to January 4. The permanent secretary writes from New Orleans that the local committees are enthusiastic and will work hard for the success of the meeting. That it will be an important and successful meeting is assured, provided the attendance is satisfactory.

The question of railroad rates has not as yet been thoroughly settled, but it seems likely that a one-fare rate will be secured from most of the railroad associations. The opportunity, therefore, to members of the association (especially from the northeast) to visit New Orleans, will be an exceptional one. New Orleans is a most interesting city on account of its historical associations, its cosmopolitan population, its extraordinary natural advantages, the wonderful flora of its parks and surroundings and the many important industries which center at the mouth of the great waterway of the United States.

Members who have not visited New Orleans should take advantage of this chance and members who are familiar with the city will gladly greet the opportunity to revisit it. Nearly all of the sections and affiliated societies will be accommodated in the lecture halls of the Tulane University (which is the state university of Louisiana) with new and well-equipped buildings. It is likely that the meeting of the Social and Economic Section will be held in the board of trade rooms in the central part of the city. The university itself is within easy access of the large hotels by trolley, the time occupied in the journey being about twenty-five minutes. The St. Charles Hotel has been chosen as hotel headquarters and promises of low rates to members are also made by the Grunewald, Cosmopolitan and other hotels. It will be well for members to write well in advance and engage rooms.

The honorary president of the local committee will be President E. B. Craighead, of the Tulane University. The executive president will be Professor George E. Beyer, of Tulane University; secretary, Henry M. Mayo, of the New Orleans Progressive League, and treasurer, Mr. Clarence F. Low, of the Liverpool, London and Globe Insurance Company.

The subcommittees are formed as follows:

Executive Committee.—The general officers and the chairman of the subcommittees.

Reception and Entertainment Committee.—Dr. Isadore Dyer, Professor John R. Ficklen, Mrs. I. L. Lyons, Miss Ida Richardson, Mrs. J. P. Richardson, Miss Kate Minor, Mrs. J. R. Ficklen, Judge Charles Fenner, Mr. George Kanshe, Miss Kate Gordon, Miss Grace King, Mrs. M. M. Davis, Mr. Charles Godchaux, Mr. E. B. Cushing, Professor B. V. B. Dixon, Mr. Lucien Lyons, Mrs. Craighead, Mr. Theodore Lyons, Captain I. L. Lyons.

Hotels and Boarding Houses.—Andrew Blakley, Theodore Grunewald, Joe Voegtle, J. K. Denechaud, Henry M. Mayo.

Meeting Place and Equipment.—Professor Wilkinson, Professor Creighton, Professor Caldwell, Jr., Professor Anderson, Professor Smith, Professor Barnett and Professor Miller.

Membership Committee.—James H. Dillard, L. W. Wilkinson, Professor W. B. Smith and Dr. J. W. Caldwell.

Transportation Committee.—Hunter C. Leake, Charles Marshall, J. Kemp Ridgely, Robert Strong, E. B. Cushing, D. C. Cunan.

Press and Printing.—John Dymond, Sr., John Dymond, Jr., Ashton Phelps, T. G. Rapin, Major T. E. Davis, Captain J. W. Bostick, Page M. Baker, Norman Walker, Robert Ewing, J. M. Leveque, J. Walker Ross, Henry Steir, Professor J. Hanno Deiler, Professor Alcée Fortier, A. Capdeville, Dr. Martin A. Aldrich, Dr. J. S. Barnett, Professor Walter Miller.

The executive committee of the council of the association consisting of the permanent secretary, the general secretary, the secretary of the council and all secretaries of sections will meet at the office of the permanent secretary in the St. Charles Hotel, at noon, on Thursday, December 28, to revise the program for the week and to make the final arrangements for the opening session of the association, which will be held in one of the large halls of the city, at ten o'clock, on Friday, December 29. The meeting will be called to order by the retiring president, Professor Farlow, who will introduce the president elect, Professor C. M. Woodward. Addresses of welcome will be delivered by Governor Blanchard, by President Craighead and by Mayor Behrmann, and to these addresses President Woodward will reply. The addresses of the vice-presidents of sections will be distributed throughout the week in accordance with the plan adopted at the Philadelphia meeting of the association.

Special features of the meeting will include the address of the retiring president, Professor Farlow, and the public evening lectures will include, if possible, one by some eminent authority on the 'Panama Canal' and another on the subject of 'Irrigation and Drainage.' There will also be an important symposium under the auspices of Section K on the subject of yellow fever and other insect-borne diseases. In this discussion, it is hoped that prominent specialists from the north will take part and that addresses will be made by the men who have borne the brunt of the fight against yellow fever in New Orleans during the past summer, especially Dr. J. H. White, who has had charge of the situation for the Public Health and Marine Hospital Service, Dr. Souchon, president of the State Board of Health, and Dr. Kohnke, the health officer of New Orleans, and others.

The local committee will arrange for receptions and excursions to places of interest and route maps of the city will be prepared indicating points of historical interest. The folklore of Louisiana will be handled in an especially interesting manner before Section H.

The following affiliated societies have notified the permanent secretary that they will meet with the association at New Orleans: the American Chemical Society, the Botanical Society of America, the Fern Chapter, the Association of Economic Entomologists, the Southern Society for Philosophy and Psychology, the Society for the Promotion of Agricultural Science.

SCIENTIFIC NOTES AND NEWS.

Lord Rayleigh has been recommended by the council for election as president of the Royal Society at the anniversary meeting on November 30.

LORD KELVIN has been elected president of the Royal Society of Edinburgh.

THE Janssen medal of the French Astronomical Society has been awarded to Mr. Percival Lowell for his work on Mars.

DR. JOHN BEDDOE, F.R.S., has been presented with the Huxley medal of the Anthropological Institute for his services to anthropology.

WE learn from *Nature* that a gathering of the old pupils of Mr. Francis Darwin, F.R.S., formerly reader in botany, was held in the botany school of the University of Cambridge on October 28, when his portrait, by Mr. W. Rothenstein, was presented to the botanical department by a body of subscribers, all formerly his pupils. To Mr. Darwin himself was presented a book containing autographs of his pupils. Speeches were made by members of the staff and by other botanists regretting the severance, after twenty-one years, of Mr. Darwin's connection with the botanical department.

PROFESSOR ADAM POLLITZER, of Vienna, well known for his researches on otology, recently celebrated his seventieth birthday, and in accordance with the Austrian law will retire from academic service at the end of the present year.

PRESIDENT DAVID STARR JORDAN, of Stanford University, left Palo Alto on November 8 for New York, where he will attend the meeting of the trustees of the Carnegie foundation for pensioning college professors.

The Observatory says that among visitors at Greenwich lately were Professor W. J. Hussey, professor of astronomy at the University of Michigan, and Professor W. W. Campbell, director, and Dr. and Mrs. Perrine, of the Lick Observatory. Professor W. S. Eichelberger, of the U. S. Naval Observatory, and others who attended the conference at Oxford in September have also visited Greenwich.

PROFESSOR WILHELM OSTWALD is delivering at the Massachusetts Institute of Technology a course of six lectures in German on 'The Historical Development of Chemistry.' The course began on November 9.

BARON ERLAND NORDENSKJOLD has returned from an eighteen months' anthropological expedition to the Andes and the northern forests of Bolivia, where he was accompanied by Lieutenant E. de Bildt and Dr. Holmgren.

A MEMORIAL bust of the late Dr. Joule was unveiled on October 28 at Sale, near Manchester. The ceremony was performed by Sir William Bailey, president of the Manchester Literary and Philosophical Society, who delivered an address.

PROFESSOR RALPH COPELAND, astronomer royal of Scotland and professor of astronomy at the University of Edinburgh, died on October 27, at the age of sixty-eight years.

PROFESSOR F. W. HUTTON, F.R.S., curator of the Museum at Christchurch, New Zealand, and president of the New Zealand Institute, died on October 27, at the age of sixty-nine years. Professor Hutton was well known for his contributions to geology, zoology and the theory of evolution.

THERE will be a civil service examination on December 6 to fill a vacancy in the position of computer (male) in the Forest Service at $1,000 per annum.

AT a meeting of the council of the Royal Society on October 26 the treasurer announced that he had received from Mrs. Tyndall a check for £1,000, which, in accordance with the wishes of the late Professor Tyndall, she desired to have applied to the general purposes of the society.

AT a meeting on October 31 of the general committee of the British Association the following resolution, which has reference to the meeting of the association in 1907, was unanimously adopted: "That having regard to the fact that no meeting of the association has as yet been held in Leicester, the general committee decides to accept the cordial invitation from that town, and at the same time expresses its most hearty appreciation of the kind and courteous invitation from the city of Dublin, and ventures to express the hope that the invitation may be renewed at an early date."

THE telescopes and instruments of the late Dr. Isaac Roberts were sold by auction by

Mr. J. C. Stevens on October 17. The equatorial with the 20-inch reflecting telescope and the 7-inch Cooke refractor are now in the possession of Mr. James Bower, an amateur astronomer of Norwich.

It had been expected that the Simplon tunnel would be opened on January 1, but it is now announced on official authority that the line will not be ready before May 1. Hopes are entertained that this delay will enable electric traction to be employed from the first, a plan which temporarily had been abandoned, but which the Italian government is understood to be desirous of seeing realized.

According to a cablegram from Brussels, the Belgian government has authorized an international lottery to collect $2,000,000 for an expedition to the North Polar regions.

The Liverpool School of Tropical Medicine announces that it proposes to appoint two qualified medical practitioners to work on trypanosomiasis and spirillosis at the school. The salary to be paid is at the rate of £100 per annum.

Mr. Henry F. Shaw, of Boston, well known in railway circles for his devotion to the problem of balancing the reciprocating parts of locomotives, has presented to Purdue University a model locomotive embodying his latest design. The model is constructed on the scale of one inch to the foot, and is an excellent piece of work.

The inaugural meeting of the British Science Guild was held at the Mansion House, on October 30, under the presidency of the Lord Mayor of London. Sir Norman Lockyer, in presenting a report on the action of the organizing committee, said, according to the *British Medical Journal*, that the object of the Guild was to encourage the application of scientific method to practical affairs, and especially to education, which should be based upon things and thinking as well as upon words and memory. On the motion of the Bishop of Ripon, seconded by Lord Strathcona and Mount Royal, and supported by Sir W. Mather, the Right Hon. R. B. Haldane, K.C., M.P., was unanimously elected first president of the British Science Guild. In acknowledging his election, Mr. Haldane said that the object of the Guild would be the bringing of method, the bringing of thinking, into the modes of government in public affairs and private industries alike. After referring to the deficiencies in scientific education of the officials of the treasury, the home office and the board of trade, Mr. Haldane said that he believed that things would not be put right until a scientific corps was formed under a permanent committee, just as the defence committee was under the prime minister. Such a corps should consist not merely of officials but of the most eminent scientific men, who would serve in it because they felt that they were honored and put on a proper footing and recognized as a body of men charged with the duty of advising the great department of state on organizing the scientific work of the country. Subsequently a number of vice-presidents and officers of the guild were elected, and a vote of thanks to the Lord Mayor brought the proceedings to an end.

Reuter's representative has had an interview with M. Henryk Arctowski, a member of the scientific staff of the Belgian Antarctic expedition of 1897–1899, which was the first to winter in the south polar regions. M. Arctowski is actively interested in the new scheme of polar exploration as set forth in September at the Congress of Mons, in which King Leopold took such great interest and attended personally. M. Arctowski has just visited London in order to confer with several geographical authorities on the possible outcome of the resolution taken at Mons. He proposes to begin the systematic exploration of the Antarctic regions by a preliminary circumpolar expedition which, organized in Belgium, would leave Antwerp next autumn with the object of exploring the most unknown sections of the south pole in view of finding new lands and suitable places for the establishment of subsequent wintering stations. The most interesting part of M. Arctowski's project is his idea of utilizing an automobile, of special construction, to penetrate into the interior of the Antarctic Continent. He thinks that if this experiment were successful, automobiles could be used on the inland ice to

transport all the material necessary for the establishment of a far advanced station in the interior, whence further explorations could be made. Scientifically this station near the south pole would add very much, by its observations, to the *data* collected by the several expeditions which would be sent out in accordance with the plan of the Association of Polar Explorers.

THE London *Times* says that in view of the suggested transmission of disease by telephone mouthpieces, the General Electric Company has brought out an instrument in which any danger of the sort is avoided by the simple expedient of abolishing the mouthpiece altogether. The receiving and transmitting apparatus is combined in a small metal case, shaped like a watch, which is held continuously to the ear both in speaking and in listening, the transmitting microphone being made so sensitive that it becomes unnecessary to concentrate the sound waves on it by the aid of any mouthpiece such as is ordinarily used. Mounted on a handle, with a speaking key, the new arrangement is exactly similar to the common combined receiver and transmitter, except that there is no mouthpiece, and the speaker, as it were, addresses himself to the world at large, instead of talking into a trumpet-shaped orifice.

A REPORT on the production of natural gas in this country during 1904 will soon be published by the United States Geological Survey. This paper, of which Mr. F. H. Oliphant is the author, contains much information about the composition, production, consumption and uses of this ideal household fuel. The United States is fortunate in its possession, as it produced 98 per cent. of the entire known world's production of natural gas in 1904. This production amounted approximately to 256,645,000,000 cubic feet, or 6,159,480 tons of 2,000 pounds. The value of this production was $38,496,760, which was an increase of $2,688,900 over the value of the 1903 production. There was much active work in 1904 in the new fields of central Ohio and southeastern Kansas. In Kansas a number of remarkably large wells were developed. A large amount was expended in drilling wells, extending many pipe lines, and piping cities and villages in these states. In West Virginia a considerable number of new wells of large capacity were drilled and connected to the main lines. Four states, Pennsylvania, West Virginia, Indiana and Ohio produced 93.3 per cent. of the entire value of natural gas produced in the United States in 1904. The output of Pennsylvania alone represented 47 per cent. of the entire value. This is interesting when it is remembered that Pennsylvania is the oldest state producing natural gas in large quantity.

PROFESSOR SILVANUS P. THOMPSON writes, according to the London *Times*, "No one seems to have recalled, in connection with the commemoration of Sir Thomas Browne, at Norwich, that he was the first person to use the word 'electricity' as a noun. Gilbert and others who followed him had adopted the term 'electrics' to denote substance which, like amber, became attractive when rubbed; but they had used no name for the unseen itself. The first occurrence of the substantive in English (or, for that matter, in any language) occurs on page 79 of the 'Pseudodoxia Epidemica' (1646) in the following passage: 'Glasse attracts but weakely though cleere, som slick stones and thick glasses indifferently; Arsenic not at all; Saltes generally but weakely, as Sal Gemma, Alum, and also Talke; nor very discoverably by any friction: but if gently warmed at the fire, and wiped with a dry cloth, they will better discover their Electricities.' Sir Thomas Browne also claims the gratitude of posterity for the narration on page 76 of his own experiments to expose the fable of the wireless telegraphing by sympathy between two magnets."

UNIVERSITY AND EDUCATIONAL NEWS.

MR. JAMES SPEYER has given to Columbia University $50,000 to endow the Theodore Roosevelt professorship of American history and institutions at the University of Berlin. Dr. J. W. Burgess, professor of political science and constitutional law and dean of the faculty of political science at Columbia Uni-

versity, has been nominated as the first incumbent of the chair.

A technical high school with accommodations for 1,200 people will be erected in Newark, N. J.

An anonymous gift of £50,000 has been made to the University of Birmingham toward the completion of the new building. The present donation makes the fourth of £50,000 which has been received. The other donors were Mr. Carnegie, Sir James Timmins Chance, and 'Anonymously.' Up to the present the council have authorized an expenditure on the new University at Bournbrook of £250,000 on buildings and £100,000 on equipment. By the latest donation the total fund in the possession of the council is increased to £450,000. In addition the city council have given a halfpenny rate, which is equivalent to £6,000 a year, and the county councils of Staffordshire and Worcestershire are subsidizing the university to the amount of £500 a year each. The Guardians of the Standard of Wrought Plate have decided to make a grant of from £200 to £300 a year.

The new zoological department of the University of Liverpool, including the museum and laboratories of zoology and of the practical applications of zoology, will be opened on November 18 by the Earl of Onslow.

On October 16 Bellevue College, at Bellevue, Nebr., celebrated the twenty-fifth anniversary of its founding with appropriate ceremonies, including an historical address by Rev. D. R. Kerr, D.D., former president of the college and now president of Westminster College, Fulton, Mo. On the same occasion occurred the inauguration of the new president, Rev. G. W. Wadsworth, D.D., for some years president of Occidental College, Los Angeles, Cal. The faculty of the college has been strengthened this year by the addition of Mr. A. S. McDaniel, A.B. (Wabash), A.M. (Wisconsin), late fellow in chemistry at the University of Wisconsin, as assistant professor of physical science. A. A. Taylor, Ph.D., continues in charge of the natural sciences.

Dr. Owen L. Shinn and Dr. Walter T. Taggart have been promoted to assistant professorships in chemistry at the University of Pennsylvania, and Dr. Roger C. Wells (Harvard) has been appointed instructor in physical chemistry.

The following appointments in chemistry have recently been made of graduates of the University of Pennsylvania: R. D. Hall, Ph.D., and R. O. Smith, Ph.D., instructors at the University of Wisconsin; Jas. R. Withrow, Ph.D., instructor in the University of Illinois; Hume Bedford, Ph.D., instructor in the University of Maine; Miss Alice L. Davison, teacher in the College for Women, Columbia, S. C.

Mr. Charles J. C. Bennett, who received this year the doctor's degree in education and psychology at Columbia University, has been appointed professor of education in the Louisiana State University.

Dr. W. A. P. Martin, who has been for the past three years associated with the Viceroy Chang Chih Tung in the cause of western education, is about to assist in the formation of a great union college in Pekin, an institution which will be supported jointly by the missionary societies of the methodist, the congregational and the presbyterian churches. This enterprise is planned as a model for the guidance of the Chinese government schools.

Mr. F. S. Pinkerton has been appointed professor of applied mathematics at Cardiff.

The following appointments have been made at the University of Liverpool: Dr. A. W. Titherley, lecturer in organic chemistry; Dr. W. G. Smith, lecturer in experimental psychology; Dr. H. Bassett, assistant lecturer and demonstrator in chemistry; W. Mason, assistant lecturer in engineering; G. E. Scholes, assistant lecturer and demonstrator in engineering; C. A. Sadler, assistant demonstrator in physics.

Erratum: The review of 'The Educative Process,' by William Chandler Bagley, printed in the issue of Science for November 3, was written by Professor E. A. Kirkpatrick, State Normal School, Fitchburg, Mass. We much regret that through an error it was assigned to Professor Wilbur S. Jackman.